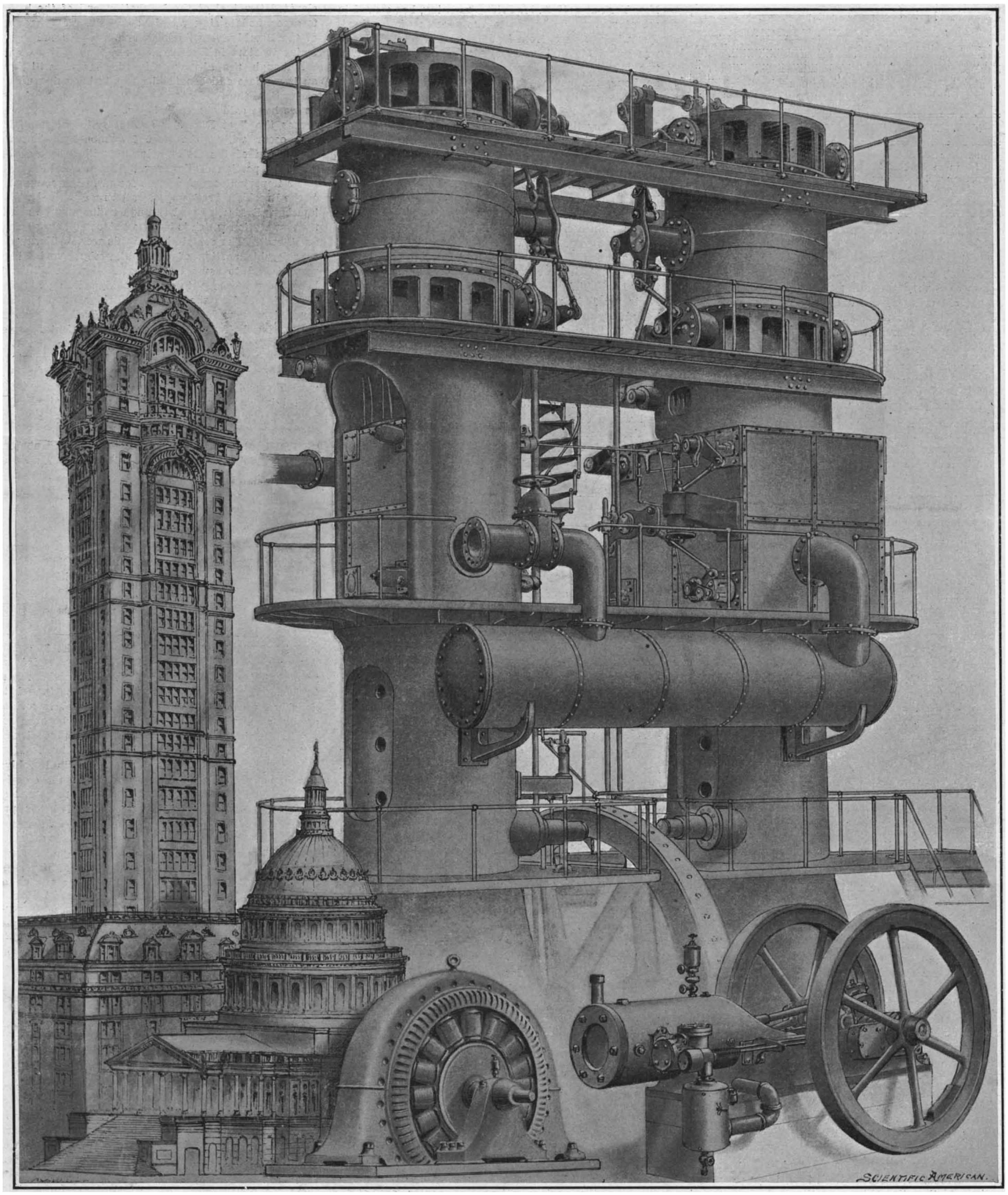
SCIENTIFIC AMERICAN

(Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1907, by Munn & Co.)

Vol. XCVII.—No. 16.
ESTABLISHED 1845.

NEW YORK. OCTOBER 19, 1907.

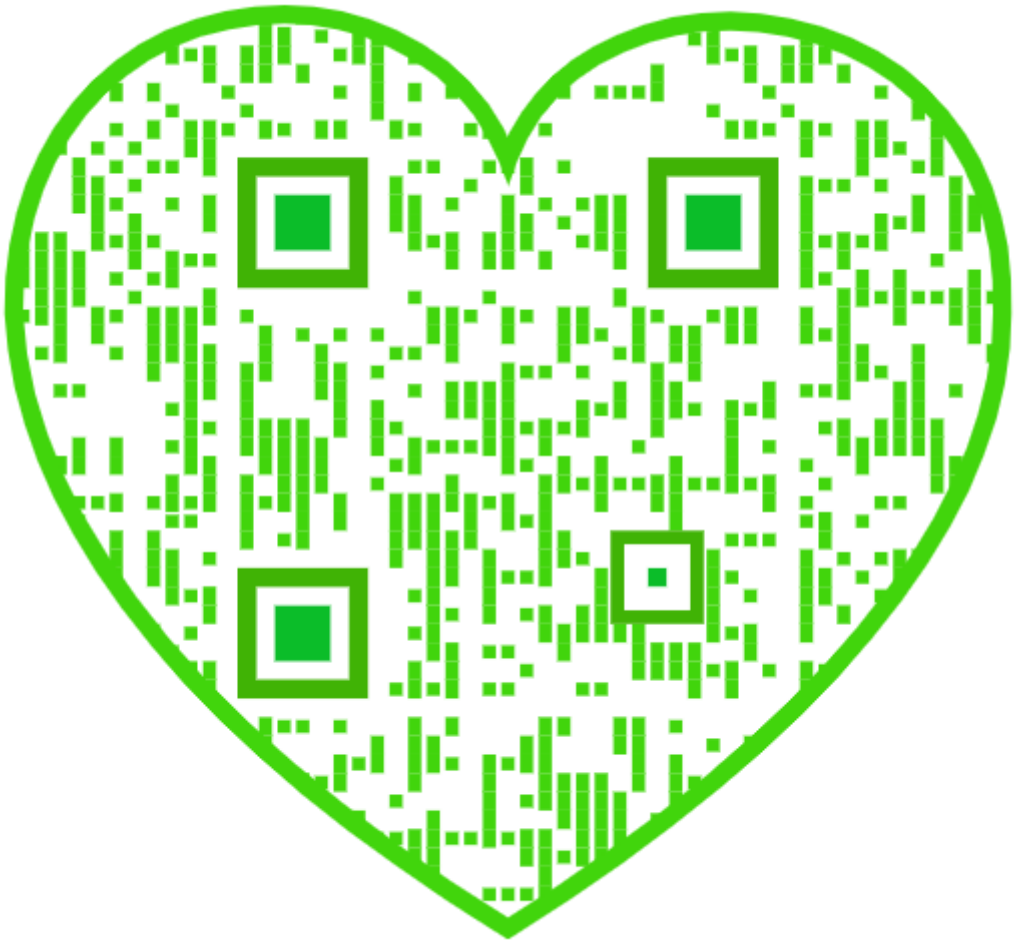
10 CENTS A COPY
$3.00 A YEAR.



The total steam power employed in manufactures in the United States in 1905 was 10,664,560. A single steam engine of this power would measure 400 feet by 255 feet on the base, and would extend 735 feet into the air, or 123 feet above the Singer building. To develop the total electrical horse-power of 1,138,208 would call for a generator with a 134-foot base, and 126 feet high. The total of 289,514 gas engine power would require an engine 350 feet long by 80 feet high.

GRAPHIC REPRESENTATION OF THE ENORMOUS ENERGY EXPENDED IN MANUFACTURES IN THE UNITED STATES.—[See page 274.]

© 1907 SCIENTIFIC AMERICAN, INC.



SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO. - - Editors and Proprietors

Published Weekly at
No. 361 Broadway, New York

CHARLES ALLEN MUNN, *President*
361 Broadway, New York
FREDERICK CONVERSE BEACH, *Sec'y and Treas.*
361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States or Mexico..... $3.00
One copy, one year, for Canada..... 3.75
One copy, one year, to any foreign country, postage prepaid. £0 18s. 6d. 4.50

THE SCIENTIFIC AMERICAN PUBLICATIONS

Scientific American (Established 1845).....$3.00 a year
Scientific American Supplement (Established 1876)..... 5.00 "
American Homes and Gardens ..... 3.00 "
Scientific American Export Edition (Established 1878)..... 3.00 "
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, OCTOBER 19, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for t regular space rates.

OLD FRENCH MACHINERY AT PANAMA DOES GOOD WORK.

We have been so accustomed to consider the French machinery at Panama as a worthless asset, that it comes as a very gratifying surprise to learn that one of the old dredges, which had been lying in the Rio Grande River for more than twenty years, has been rebuilt at a moderate cost, and is now capable of excavating 120,000 cubic yards of material per month; or as much as can be removed by four of the most modern 95-ton five-yard steam shovels. When the dredge has been put in service at the La Boca entrance to the canal, it will be capable of doing more work than a modern dipper dredge costing $102,500. The story of the reconstruction of this derelict reads almost like a romance; for the various parts which have been used in rebuilding were all of French construction, and were found in the jungle or among other abandoned material scattered along the line of the canal, all of which had lain neglected and exposed to the action of the elements for fully two decades. Thus, the three boilers, which were found in the jungle near San Pablo, were in excellent condition, being quite free from corrosion. In good shape, also, were the two cylinders; and it seems that the engine, which was in place in the hull, was, in the words of the Canal Record, "in excellent condition, and could not be surpassed by modern machinery, either as to adjustment or economy of operation." Moreover, "the copper piping on all the machinery is of very heavy design, and shows more careful workmanship than is found in modern machinery." The excellent state of preservation is due, in the first place, to the high quality of the material, and, secondly, to the fact that it was all abundantly covered with white lead and grease when the work was shut down. This dredge is similar in type to an old Scotch dredge, which was reconstructed by the Panama Railroad Co. five years ago, and which has been steadily at work in the interim on the channel from La Boca to Maos Island, with a record of less than forty days out of commission for repairs during that time. It is expected that these two dredges will prove to be of about equal capacity; and that when both of them are in active operation, there will be a marked increase in the total yardage removed from the canal prism. The material removed is taken out and dumped in deep water by eight self-propelled old French hopper barges. It is also stated that another old French dredge of a similar type is now being repaired in the Cristobal drydock, and will be placed in commission about the last of this month.

THE FOUR-DAY BOAT.

The success of the "Lusitania" in steadily breaking all transatlantic records stands for something more than the achievement of an individual steamship company, commendable though that is, and for something more than the success of one of the two great maritime nations who are contending for supremacy on the high seas. For a technical journal the significance of the fine performance of this ship lies in the fact that it marks the successful accomplishment of a supreme effort in the development of the latest type of motive power, the steam turbine. For all his reputation for caution and conservatism, your typical Briton, when he does break away from traditions, is apt to go just a little further than his competitor, whether it be in the building of a 1,710-foot Forth Bridge cantilever, or the construction of a 45,000-ton turbine steamship. When the dimensions of the two new Cunarders were first announced, and it was learned that each was to carry about 70,000 horse-power in motors of what was then considered to be of a comparatively experimental and untried type, the marine world stood aghast that $13,000,000 should be risked on such a doubtful venture; and when the supposedly 25-knot "Lusitania" completed her first voyage with an average speed to her credit of 23 knots an hour only, or half a knot less than that achieved by the German boats with the reciprocating engine, there was much wagging of wise heads, and reiteration of "I told you so's"; and this in spite of the assertion of the owners that the ship had been jogged along on between two-thirds and three-quarters of her full power, and had come into port with 1,500 tons of coal in her bunkers.

The second trip of the "Lusitania," which commenced at 10:25 A. M. on Sunday, October 6, and ended at New York at 1:17 A. M. Friday morning, has served to set at rest all doubts as to the success of this boat. The whole voyage from Daunts Rock to Sandy Hook was completed in four days, nineteen hours and fifty-two minutes, at an average speed of just 24 knots an hour, the passage being made in five hours and four minutes less time than was taken on the vessel's maiden trip. Added significance is given to this performance by the official announcement that the vessel was not driven to her full capacity, the intention being to let her extend herself a little more on each succeeding voyage, until she has demonstrated her maximum transatlantic speed. It should be remembered that her contract with the government, on which hinges the payment of a $750,000 annual subsidy, makes it necessary for the "Lusitania" to make a complete voyage from Queenstown to New York and back at an average speed half a knot faster than was made on this trip, or 24½ knots an hour. Seeing that the "Lusitania" averaged on her trials nearly 25½ knots for 1,200 miles, there can be little question of her ability to make sure of the subsidy. When everything is thoroughly shaken down, and the officers and the crew are familiar with the ship, it will not be surprising if, under favorable conditions of a smooth sea and fair weather, she should make the run at 25 knots an hour, or in four and a half days. This would bring the ship to her dock in New York Thursday evening, and would enable not only New York, but cities far in the interior, to receive their mail one day earlier than they do at present—a convenience which, in itself, would go far to justify the great expense of the construction of these two fine ships. The arrival of these boats on Thursday evenings could be made a certainty by setting the hour of departure of the last mails from London three or four hours earlier in the day than at present.

In addition to securing the land-to-land record, the "Lusitania" on two days broke the record for all-day steaming, doing 608 knots on one day and 617 knots on another, as against the highest previous record of 601 knots, credited to the "Deutschland." Her average speed of 24 knots an hour is about half a knot faster than the highest average of the "Kaiser Wilhelm II." and the "Deutschland." In looking back over the record for the past fifty years of transatlantic travel, it is interesting to note how steady has been the increase in speed and the reduction in time. In 1856 the "Persia" crossed over the same course in 9 days, 1 hour, and 45 minutes. The first eight-day boat was the "Scotia," which in 1866 cut the record to 8 days, 2 hours, and 48 minutes. To the "City of Brussels" is due the credit of being the first seven-day boat, her time being 7 days, 22 hours and 3 minutes, made in the year 1869. It took eleven years to bring the record below seven days, the honor of this performance falling to the "Alaska," which, in 1882, made the trip in 6 days, 18 hours, 37 minutes. Seven years later, in 1889, the "City of Paris," the first of the twin-screw liners, reduced the time to 5 days, 19 hours and 18 minutes. To develop the four-day boat has required eighteen additional years of development; and apparently the feat became possible only with the advent of the Parsons steam turbine.

PROSPECTS OF RELIEF OF BROOKLYN BRIDGE CRUSH.

The Public Service Commission is to be congratulated upon the lucid analysis which it made in a recent report on the causes of the Brooklyn Bridge crowding and the probabilities of its early relief. The congestion was rendered inevitable by the fact that the Brooklyn Bridge is practically the only avenue between the two most important boroughs of the city, and that no less than eight elevated lines in Brooklyn are focused onto the single elevated bridge track, and sixteen Brooklyn surface lines converge onto the one trolley track. Evidently, the most rational method of relieving the congestion would be to divert as many of these tracks as possible to other river crossings, whether by tunnel or bridge. This, however, will take time, and can only be done by degrees as the various alternative routes are completed and put in operation.

Meanwhile, it is possible to quite materially reduce the congestion by putting in operation various devices and plans designed to give temporary relief. One of the most important of those which have been adopted by the Commission, is to do away with the change of cars at the Brooklyn terminal during the rush hours, and introduce a service of through trains. This through service, and the better distribution and handling of the passengers at the Manhattan terminal, will be greatly facilitated by the construction of the large station which is to be erected on the site of the Staats Zeitung building, where the necessary clearing and excavation is now being pushed with great activity. The steps for immediate relief ordered by the Commission include the construction of new types of surface cars with double-size platforms to facilitate quick loading; increased policing to prevent disorder; increased traffic regulations to prevent obstruction on the roadways; the lengthening of the elevated terminal at the Manhattan end of the bridge to accommodate six-car trains; and the rearrangement of the Brooklyn terminals to enable additional empty trains to start in Brooklyn.

Although the above-mentioned changes will have an immediate and beneficial effect in loosening up the congestion, the fundamental remedies are to be found, as we have said above, in the opening of other routes across the East River. The first relief of this kind will occur within the next few months, when the completion of the Battery tunnel will deflect a considerable portion of the travel from the bridge. Another important agent will be found in the connection of the Brooklyn Broadway elevated road with the Williamsburg Bridge, so that through trains may be run to the new station which is being constructed below Delancey Street. The completion of this work will cause a considerable portion of the Williamsburg and Ridgewood travel to come to Manhattan by the Williamsburg in preference to the Brooklyn Bridge. The greatest relief to the Brooklyn Bridge of any single improvement under way will be afforded in about two and a half years' time, when the Center Street Subway from the Williamsburg Bridge to the City Hall, Manhattan, which is now under active construction, is completed; for the new route will afford the most direct line to Manhattan for the populous district lying between Williamsburg and Jamaica.

The Commission, judging from the present state of the work, believes that soon after the completion of the Center Street Subway, the new Manhattan Bridge, which is being built about a quarter mile to the east of the Brooklyn Bridge, will be completed and ready for traffic. As this structure will provide four sets of tracks for trains instead of one set, as on the Brooklyn Bridge, it is reasonable to expect that upon its being thrown open for service, the Brooklyn Bridge congestion will become a thing of the past. Moreover, immediately upon the completion of the Manhattan Bridge, the older structure will be taken in hand by the Bridge Department for a thorough reconstruction and strengthening and an enlargement of its present capacity.

BATTERY TUNNEL READY IN TWO MONTHS.

Apropos of the prospects of early bridge relief, we note that, if the forecast of the recent special report by Chief Engineer Rice on the Battery tunnel to Brooklyn proves to be correct, this most important section of the Rapid Transit system will be open for service in about two months' time. The present condition of the contract is that the first section in Manhattan is in operation; the third section in Brooklyn is well advanced; and the second section, the completion of which has been delayed by various more or less serious mishaps, is "in a fair way of being put in operation in about two months' time." In this section the tubes are practically complete and ready for track laying and the installation of the signal system, except for the section from the middle of the river to the Brooklyn shore. In this particular stretch of the tunnel a variety of work is being done to finish the tubes. The reconstruction work proper is entirely finished; the piles are all down, and the lining has been made watertight. The principal work remaining to be done before laying tracks consists in lining the roof and sides of the tunnel where the bottom is in fine sand, and in finishing the ventilating shaft. The report states that on account of the methods pursued by the sub-contractor, the extent of the variation provided for in alinement and grade when the tunnel was designed, was exceeded; but that those portions of the tube in sand where the trouble occurred have been now so reconstructed, that a clearance of four inches as a minimum can always be maintained throughout the work. This minimum conforms to the clearance which exists throughout the Rapid Transit Subway in Manhattan, of which this work has been made a part.

In view of the fact that the stability of a portion of the Battery tubes has been seriously called in question by more than one expert who has reported upon them, we have asked the Chief Engineer for a statement as to the exact condition of this work. He assures us that the whole of the tunnel in both tubes, from shore to shore, is a perfectly safe and reliable work; that considering the nature of the material through which it passes, it is remarkably dry; and

© 1907 SCIENTIFIC AMERICAN, INC.

that when the calking and concreting have been completed, there will be no question whatever as to its dryness and security.

SOME MECHANICAL ADAPTATIONS IN ANIMALS.

BY R. LYDEKKER.

Every one of the higher animals is in some way mechanically adapted to its mode of life and surroundings; a horse or an antelope being from one point of view a living galloping or trotting machine. Putting such examples on one side, there are numerous cases of more peculiar adaptations to which attention may be confined.

Taking climbing animals first, it may be noted that a number of species, such as Old World monkeys and squirrels, present no special modifications for a life in the trees, the essential being that they should have the power of rotating the forearm on the upper portion of the limb and that their toes should be mobile, and furnished with nails or claws.

There is, however, a group of African rodents, designated scaly-tailed squirrels, the members of which seem to have felt the necessity of additional aid for the purpose of tree-climbing. They have accordingly developed on the under surface of the tail certain structures which may be compared to the climbing-irons used by workmen. These take the form of a few transverse rows of large, triangular, horny scales, with their points directed backward. These scales, when pressed against the bark of a tree, must afford material aid in climbing. Another group of animals in which "climbing irons" have been developed is that of the scaly anteaters, or pangolins, of India and Asia—creatures which look more like living fir-cones than mammals. The scales—much larger than those of the scaly-tailed squirrels—cover both surfaces of the body, as well as the head and limbs, so that it can scarcely be supposed they have been developed for climbing. Indeed, only a few species climb; but these have found the assistance afforded by the scales on the under side of value in an ascent, and habitually make use of them as climbing-irons.

Quite a different type of climbing, or rather hanging, apparatus has been developed in the sloths of tropical America, which spend their time in the tree-tops, where they remain suspended back-downward by their hook-like claws. These claws, which may be three or two, have been modified from ordinary claws, and afford a striking instance of adaptation to an abnormal mode of life. The thumb of bats is likewise modified into a hood-like claw—also used for suspending purposes when the creatures hang head upward. Generally, however, bats suspend themselves head downward by the hind claws, grasping power being retained by the toes, so that the modification has not been carried to the same extent as in sloths, in which the claws act in a mechanical manner.

Certain bats appear to have found their hook-like thumbs and hind feet insufficient for suspension, and have made use of the sucker principle for this purpose. This mode of suspension has been developed independently in two distinct bats, one a native of Brazil and the other of Madagascar. In the Brazilian species the suckers take the form of stalked disks attached to the palms of the thumbs and the soles of the feet. The suckers of the Malagasy species are horseshoe-like. By means of the suckers these bats are able to ascend vertical surfaces. Very curious is it to note the similarity between the suckers of these bats and those on the arms of cuttle-fishes. The geckos which run up the walls and over the ceilings of houses in warm countries, afford another instance of the sucker principle. Bats are not the only mammals which have availed themselves of the sucker. In the Malay islands and the Philippines dwell large-eyed and slender-limbed little lemur-like creatures known as tarsiers, whose habits are nocturnal. In these weird little animals the tips of the toes are expanded into cushion-like disks, capable of acting as suckers, by means of which they ascend such smooth surfaces as the stems of bamboos.

Hoofed, or ungulate, mammals, such as sheep, pigs, camels, and elephants, have given up using their fore-limbs in a hand-like manner, and employ them solely for progression. Consequently, tree-climbing is out of their line. In Africa and Syria there occur, however, certain representatives of the order known as rock-rabbits, or hyrax, the Syrian species being the one referred to in the Bible as the coney (the old name of the rabbit). Certain African hyraxes have, however, taken to tree-climbing, and the way they manage it is this: In each foot the sole is somewhat cup-shaped, and by the aid of muscular action the center can be more elevated, so that when the edges are applied to the bark the foot acts like a sucker.

This sucker-like action in the feet of the tree-hyraxes is probably of recent origin, since it is certain that these animals have taken to an arboreal life at a late stage in their career. Enlisting the services of the tail to act as a fifth hand in climbing, is, on the other hand, in all probability a feature of great antiquity, seeing that it occurs in the American opossums, which are among the oldest of mammals. Doubtless, however, this development of grasping power in the tail has occurred independently in several groups. It is found not only in the American opossums, but also in their Australian cousins, which naturalists designate phalangers, and likewise in most South American monkeys, as well as in the tree-anteaters and tree-porcupines of America. In all these the extremity of the tail has a portion of its lower or upper surface naked, and marked by transverse ridges and grooves, which when applied to a bough by curling the tail-tip round it, give great grasping power. The fact that either the upper or the lower surface of the tip may be naked, implies the independent origin of the grasping power in different groups. Prehensile tails are more common among mammals inhabiting the forests of tropical America than anywhere else. The kinkajou, a relative of the raccoon, is a creature in which this feature is developed. So great is the grasping power of tails of this type that opossums and spider-monkeys when shot will remain suspended. In spider-monkeys the thumb has disappeared, although whether this is connected with the development of grasping power in the tail is not easy to decide. Probably there is no connection between the two features, the loss of the thumb being the commencement of the reduction of the hand to the hook-like organ of the sloths.

None of the animals mentioned above use their tails for any other purpose than grasping boughs, or, in the case of opossums, the caudal appendages of their parents. The Australian rat-kangaroos have, however, gone one better than this, for they employ their tails for carrying grass and other herbage for building their nests. Whether these prehensile tails are inherited from arboreal ancestors, may be a question, although they are probably a new development.

The trunk of the elephant, when contrasted with the tail of the kangaroo-rat, affords an example of the fertility in resource in animal development. In this case the specialization has proceeded farther than in the kangaroo-rat, so that the trunk is capable of serving many of the purposes of a hand. One of the most remarkable points connected with this organ is that it has been developed in the group of ungulate mammals which, as already mentioned, have abandoned the use of their fore limbs as hands, and become specialized for progression on the ground. The elephant's trunk (a development of the nose and upper lip) is therefore in one sense a confession of failure and consequently a sort of makeshift arrangement. By this I mean that in the elephant group the abolition of hands would not work, and consequently some other contrivance had to be invented to take their place.

One more instance and I have done. The antelopes and their kin are the descendants of short-limbed marsh-loving animals with large four-toed splay feet adapted to support them on yielding ground. Antelopes, on the other hand, are made for racing over hard, open plains, and their limbs are consequently long and slender, with the lateral pair of hoofs on each foot small and useless or wanting. Certain African antelopes, and more especially the situtunga of the equatorial lakes, have, however, gone back to the habits of their four-toed ancestors, and pass their time in the water or on the yielding mud of the great lakes. Now although there may be a reversion in the matter of habits, there is never any going back in nature as regards structure, and consequently the rudimentary lateral toes in these water-antelopes could not be restored to their original size. Nature is, however, resourceful, and the way in which she has managed matters in this instance is by elongating the two main hoofs, thereby giving to the situtunga a power of sustaining itself on yielding ground to as great an extent as was the case with its many-toed forerunner.

THE WATER SUPPLY OF THE UNITED STATES.

Water is by far the most important among the vast natural resources of the United States; and with the growth of cities and towns, and the advance in sanitary science, its importance is becoming more strongly emphasized each year. While large cities spend scores of millions of dollars to secure a supply of pure water, millions of acres of arid land offer agricultural possibilities provided irrigation can reach them. The rapid settling of the country adds to the problem; for while it calls for additional supply, it at the same time contaminates surface waters. The pioneer may drink from the nearest stream; the town dweller must be chary of his own well. Like other natural supplies, water has suffered in the past—and is still suffering—from neglect and waste. The consequences of deforestation—the spring floods and changing river beds; here scoured and there silted—are well known. When a well is tapped, it is at once declared "inexhaustible." In answer to this, the ground-water level in northern Indiana has fallen ten feet in ten years.

Water is a vital necessity, but it is also of great economic value. Water power for the generation of energy, water depth for the navigation of our rivers and canals, the transportation of water for irrigation purposes, are problems in which vast capital and much labor are invested. Many large projects calling for the use of water have been doomed to failure, owing to the fact that plans were made and work undertaken without sufficient knowledge of the conditions governing the supply.

The investigation of water supply is too broad a problem for State handling. Many streams traverse more than one State, and the needs of one may be the handicap of another. The United States Geological Survey has therefore been commissioned to undertake the work. Special appropriations have been made by Congress, and for several years systematic records have been made of river flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. The more important streams are being first measured; stations are established on them, and maintained for a period long enough to insure adequate average records. When sufficient data have been obtained, the work is discontinued at that point, and transferred to some other stream. During 1906 flow was studied at about 700 stations, distributed along the principal rivers throughout the United States. In addition to these records, data in regard to precipitation, evaporation, water power, and river profiles were obtained in many parts of the country.

Correct measurement of surface river flow calls for a skilled collecting of data, and much after-calculation. But it is straightforward work when properly undertaken. In the case of underground supplies of water, the problem is complicated by the difficulty of obtaining complete data. Until the folding and faulting of geologic horizons are more fully known than they are at present, it will not be possible to make the fullest or most economical use of underground water supplies. It is unfortunate that while many deep borings have been made, samples of the cuttings have been carelessly preserved or labeled, or even destroyed. In some of the Western States, where the rainfall is slight, future prosperity depends on the tapping or transportation of water. In many cases an adequate supply is stored under foot, waiting to be tapped. If the geologic horizons were fully mapped, it would be possible to indicate the exact spot for borings, to obtain the maximum flow of water. Under present chance methods of boring, some wells gush out and send millions of gallons of water to waste; others flow feebly or cease altogether. Sometimes a well is sunk which robs some other well of its flow, and in some districts of artesian wells the water level is gradually falling.

Many eastern and southern sections of the country are to-day suffering from ignorant tampering with water or water-collecting areas in past years, and a similar carelessness in the West of to-day might lead to similar trouble there in the future. It is well that the seriousness of the question is fully understood at headquarters, and is being gradually appreciated throughout the country. With wider knowledge comes a hope that this greatest of our natural resources will be developed in a broad-minded, conservative manner.

THE CURRENT SUPPLEMENT.

The current SUPPLEMENT, No. 1659, presents an unusual number of practical and useful articles. In the first place, we must mention Bradley Stoughton's excellent contribution on the Modern American Blast Furnace, in which the practical aspects of smelting are considered. The value of original research to applied science and engineering forms the subject of a brief paper. Mr. Henry C. Ter Meer writes on a method of constructing a modified electrical meter bridge, which is of such design that it can be made by anyone possessing a little mechanical skill, and at a cost which should not exceed five dollars. Mr. J. H. Morrison's paper on the development of armored war vessels passes to an eighth installment. "How Monazite is Mined" is the title of an article which should appeal to every householder, inasmuch as the mineral enters so largely into the composition of Welsbach and other forms of incandescent gas mantles. E. Ramakers contributes a copiously illustrated article on the laying of the Pupin telephone cable under Lake Constance in Switzerland. Felix Singer writes on aluminium coils, and prophesies for them an important future. The work of Berthelot, Mendeléeff, and Moissan is excellently reviewed. Dr. H. Liepmann, in an article on the left hemisphere of the brain, tells much that is new about the influence of the brain on the use of the arms and hands. Charles F. Holder tells how marine animals, such as starfishes, are photographed in their native element. The discus thrower of Castel Porziano, one of the famous statues of the Greek sculptor Myron, has probably been incorrectly restored, if we may judge by some fragments of an ancient marble copy which were discovered in July, 1906. The probable appearance of the discus thrower is depicted and described.

© 1907 SCIENTIFIC AMERICAN, INC.

SOME PRELIMINARY EXPERIMENTS IN FLYING.

BY L. J. LESH.

The art of flying has now reached a state of development that gives a great deal of satisfaction to its exponents, and provides ample inducement to new recruits entering the field.

A remarkable success has been scored by the Wright brothers, of Dayton, Ohio, and some comparatively unimportant but promising results have rewarded the efforts of other experimenters here and abroad. The success of these men has been directly proportional to the thoroughness of their preliminary training in managing motorless machines; and the numerous failures and disappointments that have developed can be traced directly to ignorance or neglect of the fundamental principles of equilibrium and control, rather than to any special defect in design or workmanship.

It is generally conceded that Lilienthal was the first man to demonstrate a practical way of learning how to fly, and that his experiments paved the way for Chanute, Pilcher, and the Wrights, who carried the work on after his death.

These men built machines which, when launched from a height, would support the weight of a man, and descend in gliding flight to the ground. The best angle of descent obtained was about five degrees, the machine sailing down the side of a sand dune into an ascending current of air.

After a number of experiments with gliding machines which gave indifferent results, the author ventured to suggest that in preparing to operate a motor machine, it might be better to learn to *rise* instead of fall; and since the conditions met in gliding flight were different from those met in motor flight, I became convinced that I had been working along wrong lines.

In thinking the matter over, it seemed that it would be practical to attach a long tow rope to the machine, and then rise into the air after the manner of a kite. When the wind was strong enough, it was expected that the machine would lift the weight of a man, and that the rope (one end tied to a post) would prevent the structure from drifting backward. If the wind was light, it was hoped that a horse or automobile could supply sufficient pull on the towing rope to make the machine rise.

It will be seen that in such experiments the pull of the rope corresponds to the power of a propeller, and that practically the same conditions are met in managing a motorless aeroplane towed by a rope and a flyer propelled by motor and screws.

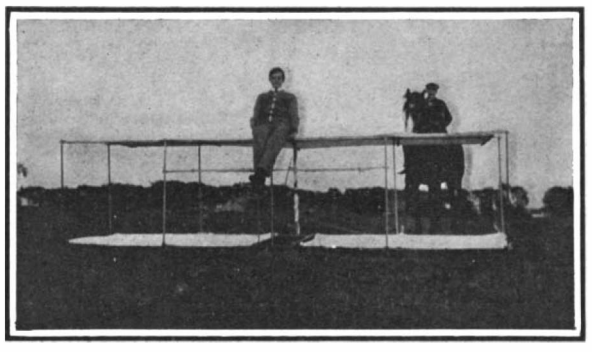
The Wrights, of Dayton, and Israel Ludlow, of New York, made use of these methods of experiment, but with rather unsatisfactory results. The Wright brothers abandoned the idea when it was found that a wind of over twenty-five miles an hour was necessary for support in the air, and never tried their machine by towing it behind a motor car or horse, although they might have obtained some interesting results in this way.

Ludlow designed machines, some of which were structurally weak and lacking in balance and control. They were gigantic structures, and required a tremendous pull to get them up in the air. Generally, an automobile or fast tugboat supplied sufficient power, but at times the flight resembled a tug of war, the aeroplane pulling so hard in the wind that the towing power was forced to a standstill.

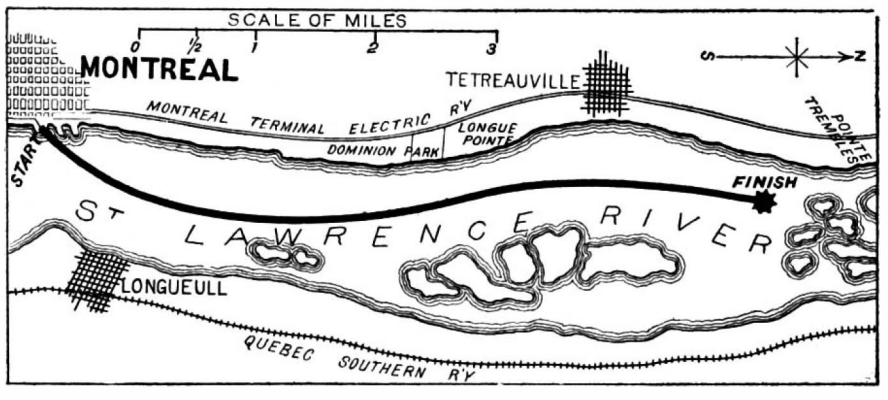
Although the prospects did not seem particularly inviting, I decided to leave off gliding experiments, and undertake the management of an aeroplane in towing flight. Accordingly, a machine having about two hundred and eight square feet of supporting surface, and weighing thirty-five pounds, was built and tested during the exhibition of the Chicago Aero Club.

Experiments with the machine flying alone in kite fashion were first conducted, to make sure of its strength and balance. These proved satisfactory, and it seemed safe to attempt the management of the apparatus in actual towing flight.

These experiments were conducted in Washington Park, the machine rising in tow of a racing automobile steered by Mr. C. A. Coey, of Chicago. Five flights were made, averaging about three hundred and fifty feet in length, at heights ranging from ten to twenty feet above ground.



This machine towed by a horse or an automobile was used in making experiments in rising from the ground. The machine had about 248 square feet of supporting surface and weighed 35 pounds. Five flights were made, averaging about 350 feet in length.



Black Line Indicates Course of Machine Over the St. Lawrence River.

These results seemed to indicate that it was quite possible to balance and steer a machine in towing flight, and that this kind of work provided better training than experiments conducted in gliding flight. Of course, if an experimenter had in mind the development of a motorless soaring machine, it would be preferable for him to acquire skill in managing a glider; but since the conditions approximating true gliding flight will never be met in dynamic aviation, the value of this kind of work to a prospective motor aeroplanist looks doubtful.

However, my previous experiments in gliding flight having proved unsatisfactory, I decided to become a little more familiar with this part of the work before devoting myself entirely to the management of machines performing horizontal flight. An ideal practice ground for gliding was found at Saugatuck, Mich., where the sand dunes rise to a height of more than three hundred feet. Suitable materials for a machine were hard to find, but a stout framework of bamboo braced with heavy wire was finally erected, and suitably tested to prove its strength and rigidity. The wings were covered with strong muslin, and a combined vertical and horizontal tail placed about five feet behind the main supporting surfaces added to the stability of the machine in the air.

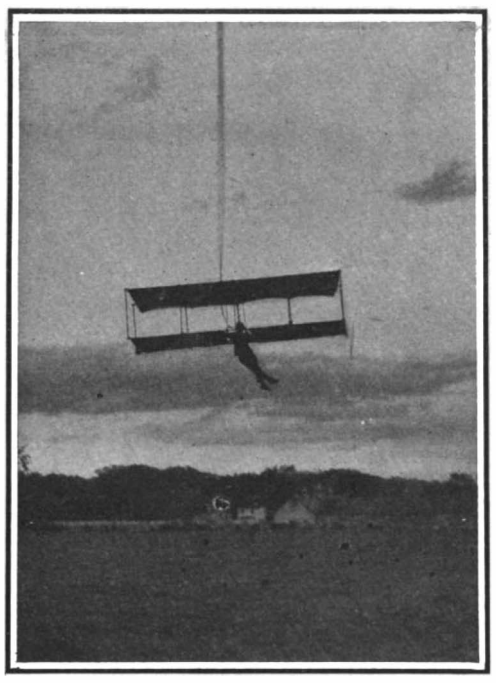
Circumstances compelled me to break up this machine before the contemplated experiments were finished, but I proved at least to my own satisfaction that more was to be learned by soaring up from a level field than by darting down the side of a sand hill. The longest glide with the Saugatuck machine was about one hundred feet at a height of about eight feet above the side of the sand dune. Gliding flight is undoubtedly the safest of the several methods of experimenting with aeroplanes, but it is not the most instructive. After coming to this conclusion, I proceeded to design and construct a flyer especially suited to experiments in towing flight. This apparatus was put up and tested at Montreal, Canada, where I was spending the summer. As first built, this machine measured twenty-two feet from tip to tip of the wings, and spread about two hundred and forty square feet of supporting surface. The frame was constructed chiefly of spruce rods ⅞ of an inch in diameter, and was fastened together by bolts. Heavy piano wire was used in trussing the structure, which, when completed, weighed about 60 pounds.

The first flight was made over land in an open field located about eight miles from the city of Montreal. A fast horse supplied the necessary pull at the end of a strong towing rope. A height of over sixty feet was attained, and the flight lasted about two minutes, during which time I covered over a quarter of a mile. The balance and control of the machine were perfect, and it did not seem that it would be overbold to attempt a much longer flight.

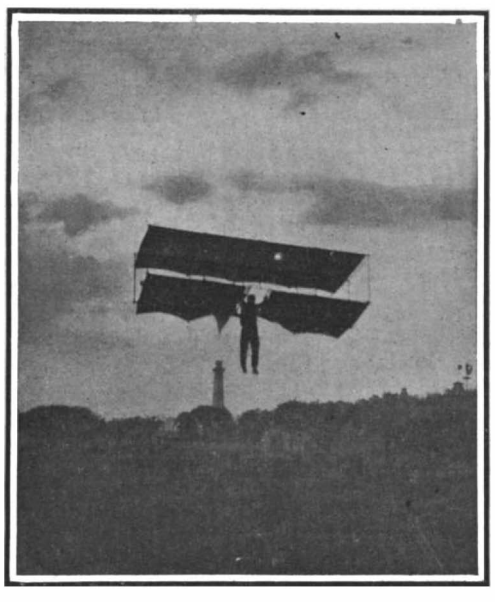
I desired to study the problems of balance and control under more suitable conditions than were possible in the e short flights over land, and so made a long and altogether satisfactory trip over the St. Lawrence in tow of a fast motor boat.

The start was made from a wharf on the Montreal side of the river, the machine rising rapidly into the face of the wind until a height of about sixty feet was reached. At this alti-

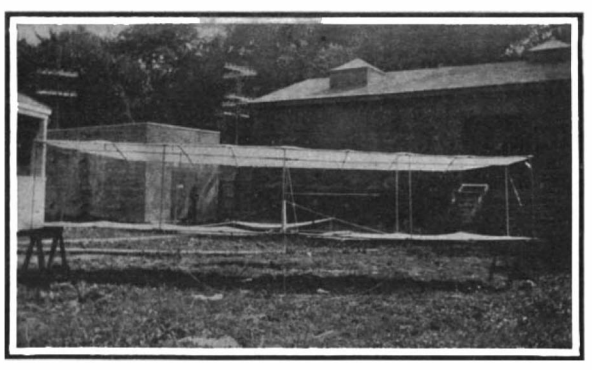
(*Continued on page 274.*)



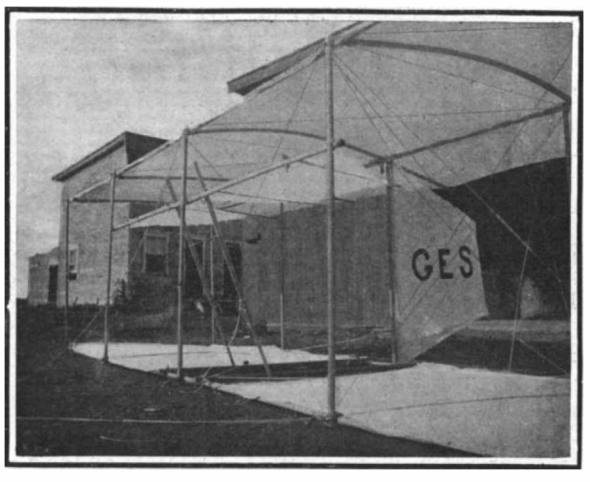
Soaring Up in a High Wind.



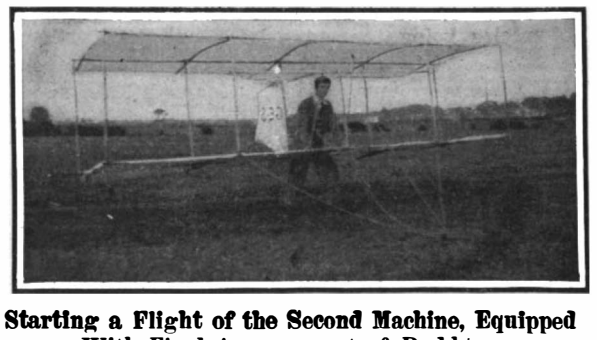
In Full Flight. The Aeronaut Sailed Over the Photographer Who Took This Picture.



The First Machine Which Was Constructed for Experiments in Towing Flight and Which Flew Over the St. Lawrence River.



The Second Machine Equipped with the Final System Rudders. This System is to be Used on a Motor-Driven Flyer.



Starting a Flight of the Second Machine, Equipped With Final Arrangement of Rudders.

SOME PRELIMINARY EXPERIMENTS IN FLYING.

© 1907 SCIENTIFIC AMERICAN, INC.

ILLUMINATING NIAGARA WITH ITS OWN POWER.

BY ORRIN E. DUNLAP.

During the month of September and for a few days in October, visitors to Niagara Falls were treated to the most wonderful spectacle of the illumination of the falls under varicolored searchlights. The night scene thus created was such as to force all to admit that those who have seen Niagara only by day have but half seen it.

For years this summer resort has longed for an evening attraction that would serve to entertain visitors remaining over night in the city, and which might also serve the good purpose of attracting many others from nearby points to enjoy the new beauty of the locality. There has been much discussion about illuminating the falls, but it fell upon Mayor Anthony C. Douglass to carry out the idea. He succeeded in raising a fund of about $5,000 for installing and maintaining the plant for a month.

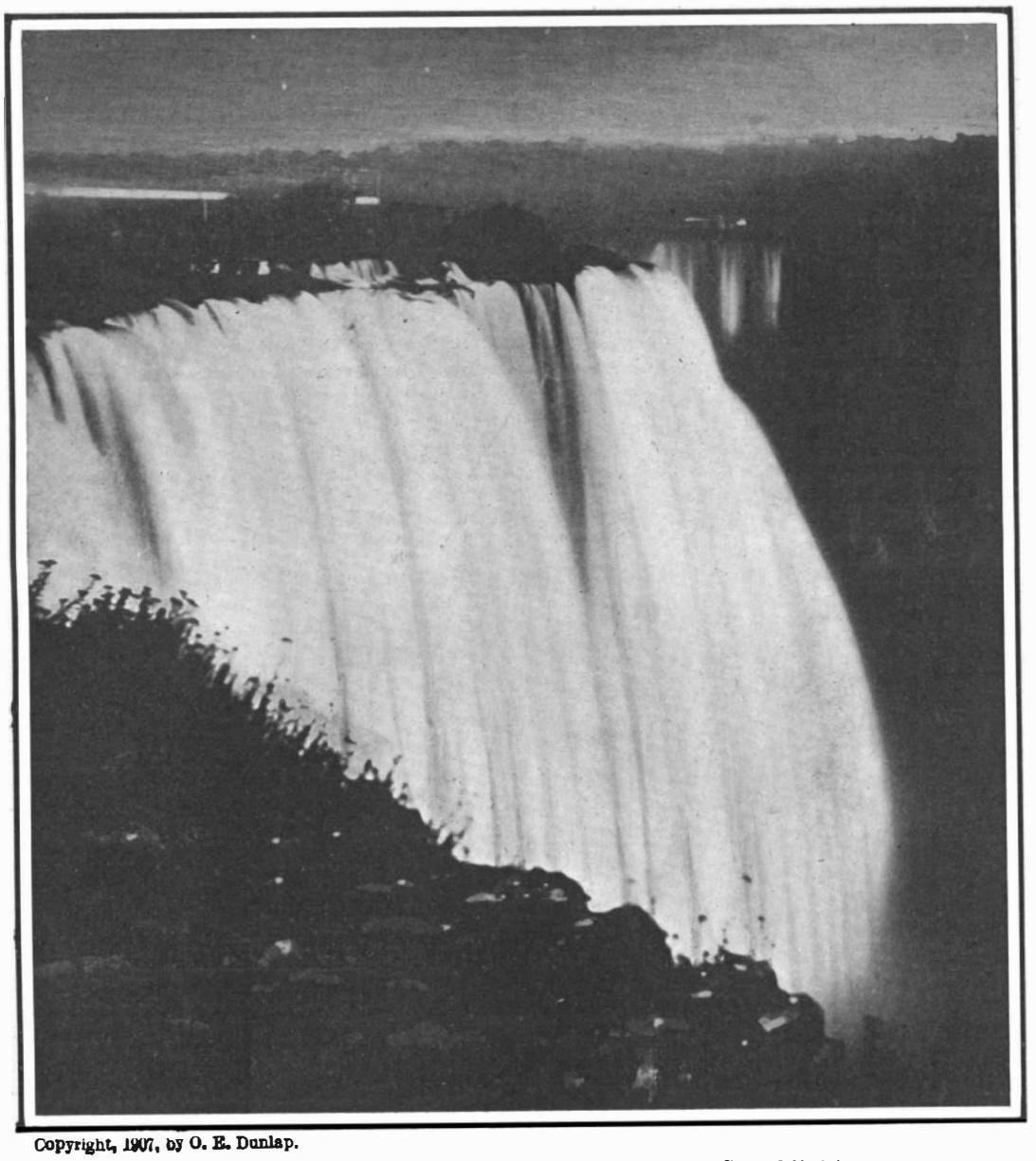
This plant consisted of eleven 30-inch and ten 18-inch projectors, installed near the water's edge in the gorge on the Canadian side of the river, a few hundred feet north of the station of the Ontario Power Company. The battery of lamps was arranged in the form of a crescent, and proved effective in lighting both the American and the Horseshoe Falls. A second battery was placed on the spillway of the Ontario Power Company on top of the cliff, the battery consisting of four 30-inch projectors, the bright beams being sent to light the upper portions of the falls and the rapids effect on top of the precipice.

The third battery was located in Victoria Park opposite Prospect Point. It consisted of eight 18-inch projectors, intended mainly for use on the American Fall. The electric current for the operation of the plant was taken from the 500-volt circuit of the Niagara Falls Park and River Railway. This was applied to the operation of a motor generator set that supplied a current of 110 volts for use in the lamps.

In front of each projector was mounted a color scintillator, this latter being designed to give the color effect to the rays as they were projected upon the falling waters.

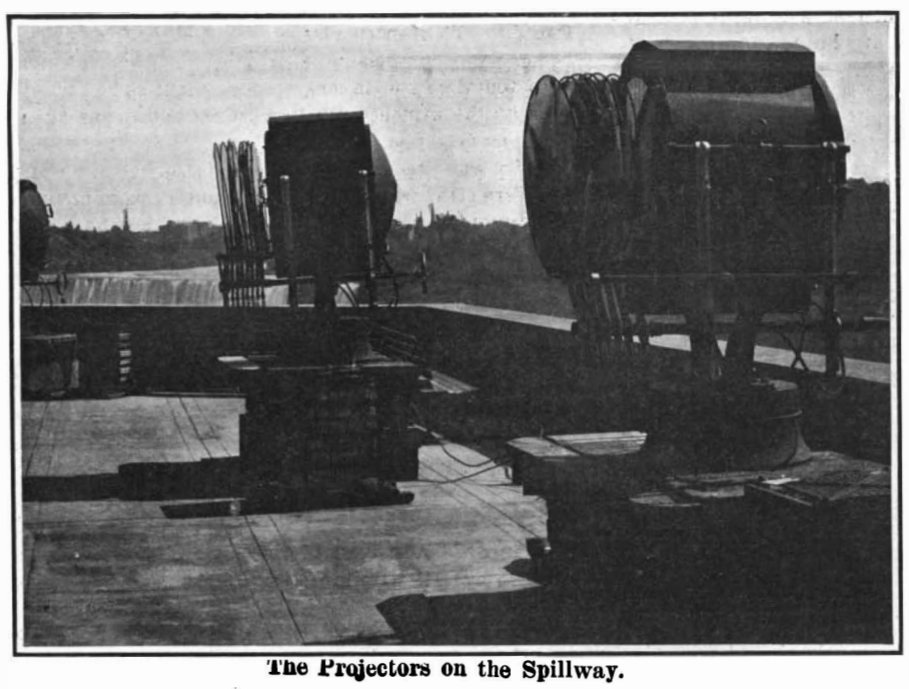
The illumination began at 8 P. M. and continued until 9 P. M. This schedule was varied to a considerable extent to meet the necessities of various parties of visitors.

The evening's entertainment was generally opened by throwing the lights on the American and Center Fall. First a soft white light was played on the water. Blue, green, yellow, red, and violet rays were turned on one by

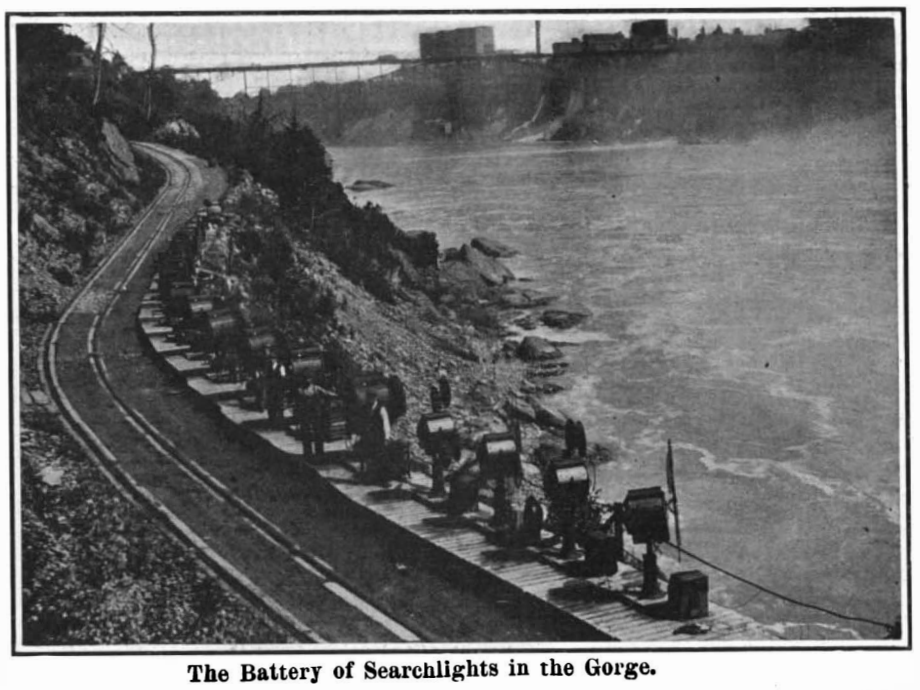


Copyright, 1907, by O. E. Dunlap.

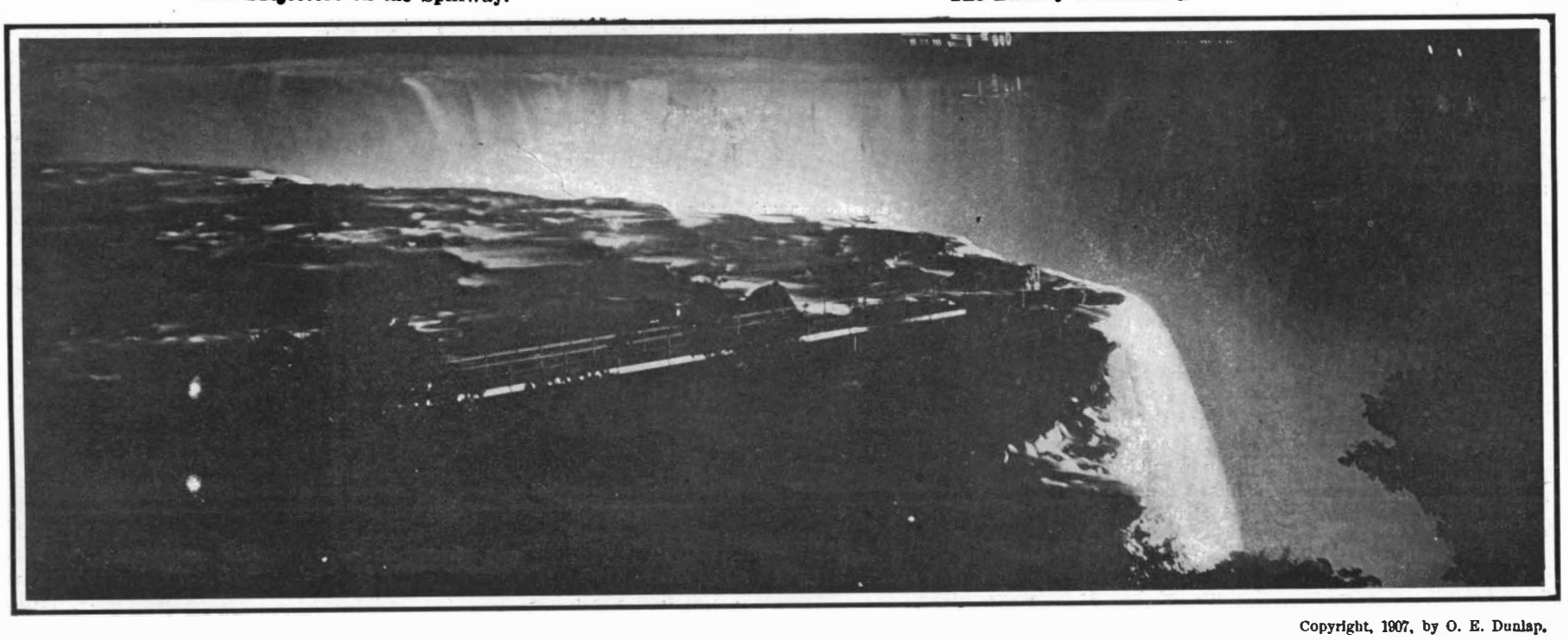
Horseshoe Fall at Terrapin Point Illuminated by Searchlight.



The Projectors on the Spillway.



The Battery of Searchlights in the Gorge.



Copyright, 1907, by O. E. Dunlap.

The Horseshoe or Canadian Fall, Showing the Rapids Illuminated by the Battery of Searchlights on the Spillway.

ILLUMINATING NIAGARA WITH ITS OWN POWER.

© 1907 SCIENTIFIC AMERICAN, INC.

one until the beautiful American and Center waterfalls were a mass of colors. Such harmony, such blending, was never before witnessed, the ever-moving, dancing spray cloud creating effects that were fascinating and dazzling. The intermingling of the colors surpassed all rainbow effects ever seen by day in this place of wondrous water beauty. The Center Fall afforded magnificent opportunity for using a solid color, and either in red or blue the glory was beyond description. The uneven face of the American Fall served to assist in a display of a different character; for the prominent part at Prospect Point was radiantly blue, while all the remaining section of the fall was illumined with chatoyant colors in glorious harmony.

At Terrapin Point the spray cloud was so dense and heavy, that the lamps did not have the power to penetrate the sheet of water and reach far into the depths of the mighty waterfall. However, a never-to-be-forgotten effect was the red, white, and blue flashed on delicate sections of the Horseshoe as it poured over the Canadian cliff.

The evening's entertainment was varied by the discharge of bombs, that developed a smoke cloud on the Canadian side to the north of the gorge battery. When this smoke cloud appeared, all the projectors were directed upon it. As the smoke ascended, it produced an artificial cloud effect that rendered possible wonderful color reflections. There were several displays every evening.

It was possible to cast the lights in any direction, and now and then they were used to outline the upper steel arch bridge, or to give spectators a glimpse of the wild beauty of the waters that pour from the tunnel of the Niagara Falls Power Company. When sent high into the sky the white beams were visible many miles, the largest lamps being very powerful.

The future of the illumination is not yet apparent. Mayor Douglass hopes to make it a nightly feature. The railroads must become generous supporters of the project, for it is already evident that they will receive the most benefit. As a feature of beauty the illumination is an unquestioned success—a superb scene that gives to the tossing, tumbling, chaotic waters of the greatest waterfalls in the universe a night splendor unsurpassed by anything on earth.

SOME PRELIMINARY EXPERIMENTS IN FLYING.

(*Continued from page 272.*)

tude the flight continued without interruption for about three miles, when an accident occurred to mar the success of the trip. The machine was equipped with a small wooden seat, swinging below the rest of the framework by two small ropes.

At a very awkward moment one of these broke, leaving the operator to hang by one arm and retie it. The repair was made without coming down, however, and the aeronaut again safely seated, the flight continued without incident for some two and a half miles farther down the river. At this point recent history repeated itself in the form of the other ropes' breaking. Not being so well prepared for this second accident, the operator came very near to taking a drop into the water, but caught the arm rests in time to avoid trouble.

With the seat out of commission and no other support for his weight available, he decided that it would be prudent to head for shore. The boatmen misinterpreted the signals, however, and becoming confused steered around with the wind, forcing him to descend.

The flyer was badly damaged during subsequent attempts on the part of the men to tow it to shore. The total distance traversed during this flight was first stated by the boatmen to be three miles; and as they were men supposed to be well acquainted with the river, I took their word for it. When the flight was actually charted on the map, however, it was found that the distance was more than six miles, the line of flight being shown on the diagram.

The machine was given a thorough overhauling, and several changes in design and method of operation were made before a third flight was attempted. This experiment ended disastrously, the flyer collapsing in mid-air after a brief struggle with the wind.

The cause of this breakage is still something of a mystery to me, for the machine withstood the most severe tests preparatory to the flight. It is possible that I put undue strains on some part of the structure, since I was not yet familiar with the new system of control. The machine was completely wrecked, but I came out unable to show a scratch. This was the first time in my experiments that any untoward accident occurred, and it seems remarkable that the result was not more serious, for the machine plunged headlong from a height of over thirty feet and struck hard ground.

This performance was rather discouraging, for it indicated that even a seemingly strong structure could not be trusted under certain little-understood conditions of flight.

I decided to design and construct my next machine in a manner that would eliminate all chance of a breakage in mid-air. Mr. Octave Chanute, of Chicago, very kindly made it possible for me to build this machine, which had turned out to be rather an expensive proposition.

In the new apparatus the span of the wings from tip to tip was reduced to sixteen feet, and the total supporting surface was cut down to about one hundred and seventy-five square feet. It was found that the resistance caused by exposed framing could be safely diminished by reducing the number of uprights connecting the surfaces and the number of ribs forming the wings. The whole structure was also strengthened considerably by incasing the framework at the joints in steel tubing.

With this new machine I felt little apprehension in flying under any condition of wind or weather, and was able to devote more time to learning the tricks of steering and balancing than before. During the first week that experiments were carried on about forty flights were made, ranging in length from a few hundred feet to over half a mile.

Much was learned concerning the eccentricities of the wind, and in fact the real object of the trials was to accustom the aviator to the management of an aeroplane rather than to acquire scientific data.

By manipulating the rudder and shifting the center of gravity of the operator, it was found possible to "quarter" into the wind for considerable distances. This feat was accomplished with the wind blowing at speeds exceeding at times forty-five miles per hour.

Although it is generally best to start and land facing into the wind, yet it is quite possible to steer to right or left near the ground, if care is taken to prevent lateral oscillation when the wind strikes the wings from the side. At the moment of landing it is important that the surfaces be nearly horizontal, or the framework is liable to be damaged in striking the ground.

After several weeks' practice I find it possible to make safe landings at considerable speed, and the machine has been damaged only three or four times. Generally, the framework does not come in contact with the ground at all, but of course an occasional awkward landing must be expected.

After about fifty preliminary flights I have taken up the actual development of a motor aeroplane, and experiments are now being conducted to ascertain the most effective system of controlling surfaces.

The experimental flyer has been fitted with the arrangement of rudders which I will in the near future install in a motor machine, and the results obtained have been very promising.

The development of a full-fledged aeroplane is a difficult proposition, but much of the bitterness of disappointment may be avoided if the investigator is willing to learn the tricks step by step. As Lilienthal and Octave Chanute pointed out, "man must fly and fall and fly and fall until he can fly without falling."

ENORMOUS POWER CONSUMED IN OUR INDUSTRIES.

On the front page of the present issue we give a graphic representation of the enormous total of horsepower which is required to run the industrial establishments of the United States. The drawing is based upon the latest available statistics on this subject, which are to be found in the report of the United States Census Bureau for the year 1905. The mere statement of figures which run into the millions conveys to the mind of the average layman no adequate idea of the quantities involved; and particularly is this true when applied to such a subject as total aggregates of engine horse-power. But when these figures are translated into concrete forms, they begin to take on intelligible meaning. Everyone is more or less familiar, either through the medium of illustration or through a visit to an actual plant, with the general appearance and the great proportions of the typical steam engine of large size used in modern power plants, whether for electric lighting, or power, or for providing the necessary air for blast furnaces. So also the general appearance of a typical gas engine, or of an electrical generator, is more or less familiar; and in the front-page illustration above referred to, the total number of units of steam engines, gas engines, and electric generators are supposed to be thrown into one, and the resulting dimensions of the single unit, thus obtained in each case, is depicted, with the great Singer tower shown in the group for comparison.

The results are certainly very striking. If the 10,664,560 steam power used in our industries were represented by a vertical cross-compound blowing engine, of the kind that is used in our blast-furnace practice, we would have a huge affair, whose base plate would cover one-half of a large city block, and the top of whose topmost cylinders would tower 735 feet skyward. The tallest building in the world to-day, the tower of the Singer building, is 612 feet in height, so that this monster engine would overtop the great building by 123 feet. Similarly, if the total electrical horse-power of 1,138,208 were to be represented by a single generator, we would have to build a machine whose base would measure 134 feet in length, and whose highest point would be 126 feet above the ground. The great proportions of this machine are shown by comparing it with the dome of the Capitol at Washington. To develop the total of 289,514 gas engine horse-power, would call for an engine 350 feet in length by about 80 feet in height from the base plate to the top of the cylinder.

The census figures showing the growth of total horse-power by decades since 1870 are of great interest. In addition to those which we have illustrated, there is a total of 1,647,969 water power, 91,784 miscellaneous horse-power, and 632,905 rented horse-power. The grand total for the whole United States is 14,464,940, as compared with a total of only 2,346,142 horse-power in the year 1870. In 1880 the total had risen to 3,410,837, an increase of 45.4 per cent. From 1880 to 1890 the total grew to nearly 6,000,000 horsepower, an increase of 74.6 per cent. The same percentage was maintained from 1890 to 1900, when the total had risen to 10,409,625 horse-power. It will thus be seen that the greatest actual relative increase occurred between 1890 and 1900; and notwithstanding the great increase in other kinds of power, steam has continued to be the motive power of greatest importance, representing in 1870, 51.8 per cent of the total horse-power employed in manufactures; in 1880, 64.1 per cent; in 1890, 76.9 per cent; in 1900, 78.2 per cent; and 73.7 per cent in the census of 1905. One of the most notable features of the development of machinery in manufactures has been the growth of the use of the electric current for the transmission of power. The first census to show electric power was that of 1890, when only 15,569 horse-power was reported. Fifteen years later this had grown to 1,138,208 horse-power. It should be noted, in connection with the above statistics, that when the electric power is generated by the manufacturer, the combination of the horse-power of the engines and the motors results in a duplication; but since in some cases the steam engines are used for purposes other than the generation of electric current, it is impracticable to avoid this duplication.

In conclusion, we would draw attention to the fact that our front-page engraving shows the day to be very far distant when the steam engine is to be relegated to a subordinate position, and the lead taken either by electricity or gas.

The Navigation of the River Danube.

One of the most important engineering undertakings in progress in Europe is the improvement of the navigation of the mouth and lower reaches of the river Danube. This enterprise was taken in hand by an international commission appointed in 1856. It was anticipated that the labors of the commission would occupy at the utmost only two years, but it has been sitting for fifty years. At the time of its inception the Danube was one of the most inaccessible and difficult of rivers, the estuary being a mass of sandbanks and treacherous swamps. During a severe gale one winter's night in 1855 alone, no less than twenty-four sailing ships and sixty lighters were wrecked in the shoals, with a loss of three hundred lives.

The task of improving this treacherous approach has, however, proved exceptionally difficult, but according to a recent report to the British government by their representative engineer, conditions have been considerably improved. Instead of there being only a minimum depth over the Sulina bar of 9 feet, there is now 24 feet of water, while the arm of the same name has been improved from a depth of 8 feet to 20 feet. The navigable channels have been straightened and there is a fairway from St. George's Chatal to Sulina only 34 miles in length, as compared with the former distance of 45 miles between the two points. The total cost of the undertaking has been $8,000,000, the money for which, however, has been derived for the most part from shipping dues. That the improvements have proved commercially valuable is shown by the increase in Sulina's maritime traffic. Since 1867 the traffic in cereals has increased fivefold. Sulina itself, owing to the installation of an elaborate sanitary system, has risen from a mere collection of huts to the status of an important and flourishing port of 5,000 inhabitants. The improvement of the estuary and the greater safety afforded to shipping has resulted in a corresponding decrease in freights, for whereas in 1856 the tariff to Great Britain averaged $11 per ton of cereals, it is now only $2.50, while the rate has been as low as $1.50 per ton. The improvement works are to be pushed forward as vigorously as in the past.

Eugene Godet, a French aeronaut, had a narrow escape from being drowned in a recent ascent at Jamestown, Va. His propelling machinery failed to act, and the wind swung the airship against a water tower, both propellers being knocked off. Relieved of the weight, the airship rapidly ascended, and when over Hampton Roads suddenly dived toward the water but again arose and drifted away. Godet clung to his machine, and finally landed in a badly bruised condition, and with a wrecked airship, fourteen miles north of Newport News.

© 1907 SCIENTIFIC AMERICAN, INC.

Correspondence.

THE DEVELOPMENT OF THE WIRELESS TELEPHONE.

To the Editor of the SCIENTIFIC AMERICAN:

Owing to the interest evinced at the present time in wireless telephony—an art I have done everything in my power to advance since 1899—the time seems ripe for the statement showing the relative positions of the various contestants in this field of endeavor.

From time to time, as the exigencies of the cases required, I have pointed out in divers technical publications the various methods that could be employed to telephone through space without connecting wires. As far back as 1898 I began to experiment with electric waves as a means for transmitting articulate speech wirelessly, and on July 18, 1902, the SCIENTIFIC AMERICAN published a description and the drawings of an apparatus I had evolved for fulfilling the exacting conditions required in wireless telephony.

The drawings of this early transmitter and receiver of mine are reproduced in Fig. 1, and the following is a paragraph from the article in question referring to its construction:

"*A* is a transmitter, and *B* the receiver. The primary coil is shown at 1, and is in series with the battery 2 and the key 3. One terminal of the secondary winding 4 is connected with a special form transmitter 6, and this to a large capacity 7. The opposite terminal of the induction coil is earthed at 8, and bridged across the terminals of the secondary is the condenser 9; 10 is a 'variator,' which will be again referred to. The receiver is quite simple, and consists essentially of a transformer coil 1, a telephone receiver 2, and a battery 3; the condenser 4 of large and equal capacity to that employed in the transmitter, and 5 the earthen terminal.

"The action of the instruments is as follows: When the key 3 closes the primary circuit, the current is automatically varied by a special device (an arc-light) 10, which takes the place of the ordinary interrupter; this produces alternations in the secondary coil 4, giving rise to high potentials at the intervals 7 and 8; this potential difference is, however, modified by the transmitter 6. The surging of the currents through the circuit formed by 7 and 8 emits waves, and these traveling with the speed of all other electro-magnetic waves reach the plate 4, and finding no other path of greater density surrounding the circuit 4 and 5, it traverses that circuit in preference to passing onward through the earth, since the former offers the least resistance. This sets up alternating currents in the transformer coil 1, and these are impressed on the telephone receiver 2."

It will be observed that the telephone transmitter, which was of the old Blake button type, was placed in the free arm of the high-tension system. At the early date when this apparatus was first used, about the only detectors known for indicating the presence of electric waves were coherers in one form or another; and where the frequencies were high a microphone detector was utilized, and when low and the waves were increased to lengths approximating those set up by mechanical vibration, a telephone receiver was employed direct.

The concluding paragraph of the article states that "both the transmitter and the receiver are mounted on tripods, providing the operators with testing apparatus almost as portable as a camera. The tests from the incipiency of wireless telephony have been made at Narberth, Pa., where the conditions were all that could be desired. In 1899 speech was transmitted to a distance of 200 feet; in 1900 a mile was covered, when with the equipment shown in the engravings articulate speech was transmitted across the Delaware River at Philadelphia; and in 1902, with the instruments placed on hills separated by a railroad, valleys, wooded lands, and numerous streams, a distance of three miles was attained. The results have shown the possible commercial value of this system of wireless telephony, which is soon to be perfected for actual use."

In the past five years I have not striven to cover long distances, the three-mile test at Narberth under the difficult conditions imposed by the geological and geographical features of the country—equivalent to ten or twelve miles over water—indicating clearly enough that wireless telephony was possible over any distance the wireless telegraph could bridge, by increasing the initial power. The real difficulty encountered was not a matter of covering distance, but of getting speech that was articulate and that could be clearly understood. To overcome this untoward result I have bended my efforts, and have succeeded so well that my receiver now produces the spoken words more clearly than does an ordinary telephone, though not so loud.

So much for my early wireless telephone work and the article describing it, and now a word concerning my contemporaneous aspirants for wireless telephone honors—Messrs. Fessenden and DeForest. In the issue of the SCIENTIFIC AMERICAN dated January 19, 1907, Fessenden publishes diagrams of a wireless telephone apparatus, but gives no adequate description of it. While I did not think it of sufficient importance at that time to call attention to many points of similarity to my apparatus of 1902, I feel now, in justice to my early work, to point them out, that he who reads may judge for himself how far I have anticipated Fessenden. Compare my transmitter, Fig. 1, with his transmitter, Fig. 2, and it will be readily seen that these are very alike. There is the same closed circuit containing an electric arc and the primary of a transformer coil. The open circuit, too, is precisely the same, except for the trivial change he has made in placing the transmitter in the grounded arm of the oscillator instead of in the free arm, as shown in my diagram.

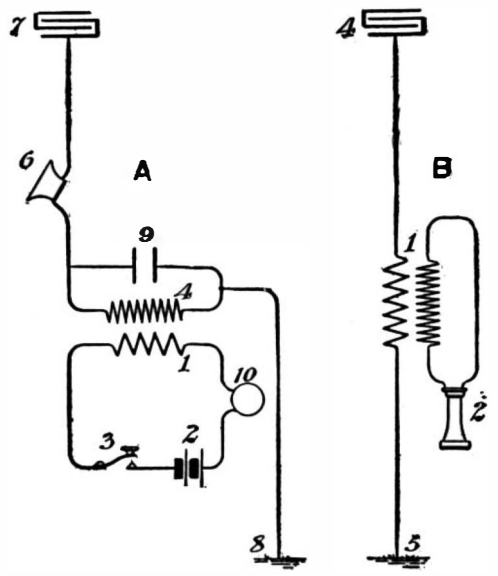
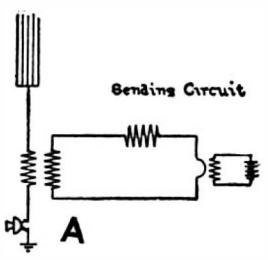


Fig. 1.—Collins Wireless Telephone Transmitter and Receiver.



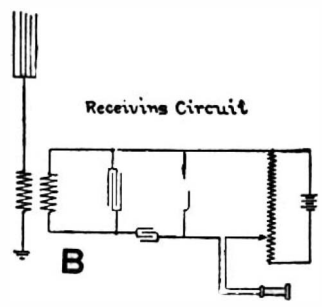


Fig. 2.—Fessenden's System.

It is also apparent that his receiver and mine are virtually the same, if we except the introduction of his electrolytic detector—a very ingenious detector for wireless telegraphy, but oppositely an exceedingly poor device for the reproduction of articulate speech.

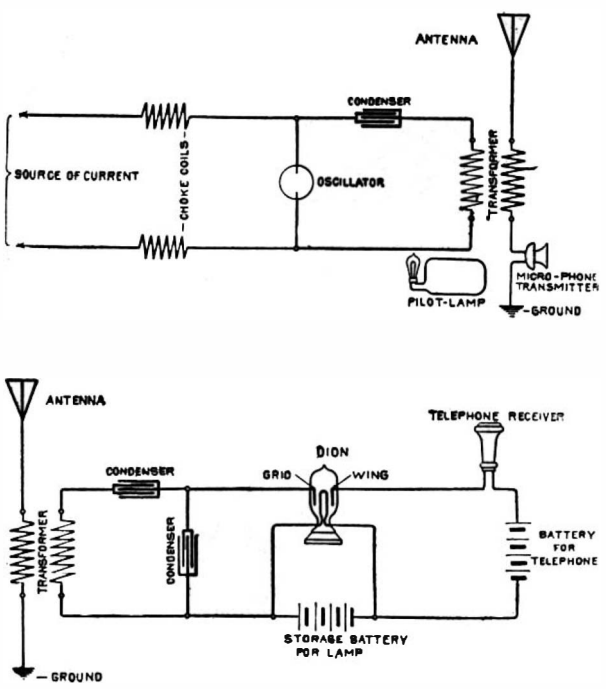


Fig. 3.—De Forest System of Radio-Telephony.

THE DEVELOPMENT OF THE WIRELESS TELEPHONE.

Fessenden also makes a statement that I strenuously object to, though it does not concern primarily my wireless telephone. In his article he refers to his "arc-gap" method. This arrangement he would have as conformed with the Duddell-Poulsen system for producing continuous oscillations. This "arc gap," as Fessenden terms it, is really the ordinary spark gap employed in all the older systems of wireless telegraphy; it has nothing in common with the tuned arc of Elihu Thomson, and is entirely different from the musical arc of Duddell, the speaking arc of Simon, or the continuous oscillation arc of Poulsen.

A new claimant for wireless telephonic honors is DeForest. Of his apparatus the SCIENTIFIC AMERICAN publishes an account in its issue of September 28, 1907. To illustrate how nearly his arrangements for telephoning without wires are like the 1902 instruments of mine, compare Fig. 3 with Fig. 1. It will be seen at a glance that they are identical in all essential respects, although DeForest copied Fessenden and placed his transmitter in the grounded arm of the oscillator circuit.

An additional detail added by DeForest and not found in my early system is "the arc light maintained in the flame of a small alcohol lamp." This scheme is due to Poulsen, and was described by me in the SCIENTIFIC AMERICAN of December 15, 1906. It has long since been superseded by immersing the terminals of the arc in hydrogen, which gives very much better results.

His receiving circuits are essentially my open and closed circuits with the addition of a detector, called by him an "audion," but which is really the oscillation valve invented by Prof. Fleming, who is Marconi's technical adviser.

With any of the arrangements shown and described, it is quite impossible to obtain satisfactory results; and evidently Fessenden and DeForest are passing through the same difficulties I encountered from 1900 to 1904, i.e., inarticulation of the received speech. Music may be transmitted to better advantage than speech, for a musical tone is simple compared with the spoken word.

In order to reproduce the human voice in clear liquid tones, a further improvement must be applied to the arrangements indicated above, and this I have done and shall make public within the next three months.

11 Broadway, New York. A. FREDERICK COLLINS.

On a Device for Balancing Aeroplanes.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the letter of Mr. Clark L. Swezey in the SCIENTIFIC AMERICAN for September 21, 1907, on a simplification of the device I had suggested in the SCIENTIFIC AMERICAN SUPPLEMENT for June 29, 1907, I would like to say that while the device suggested is certainly very simple, I hardly think it would be manageable. As I understand it, the aeroplane is to be balanced by the use of a tube, fitted with wires at each end, containing mercury. A tilting would cause the mercury to flow to one end of the tube, and so establish an electrical contact. But it is difficult to see why the mercury would not flow to an end of the tube in the same way whenever the aeroplane were accelerated, as in starting or stopping. The action, it seems, would be the same as that which takes place when a pan of water at rest on a table is suddenly pushed.

It is difficult to see, also, how the device could be modified so as to overcome this feature and yet be sensitive. ROBERT H. GODDARD.

Worcester, Mass., October 4, 1907.

Fluorescence and Chemical Constitution.

MM. Francesconi and G. Bargellini, two Italian chemists, are studying the problem whether there is some connection between the chemical constitution of bodies and fluorescence. They have examined about five hundred organic compounds in various solvents, using an extremely simple apparatus consisting of a test tube located in a dark room. A conical beam of sunlight being projected on this solution, the luminous cone is examined at the upper part of the test glass. If the compound tested is fluorescent, it shows a different color from that of the solution. The following are the main results of these experiments: No compound belonging to the fatty series is fluorescent; while all the aromatical compounds show a more or less intense fluorescence. Each of the different nuclei (benzine, naphthaline, etc.) has a fluorescent power of its own. While certain groups of atoms exert a very energetic activating action on fluorescence, others are reducing agents of more or less intensity.

Peat, which might almost be called the national fuel of Ireland, has never been very successfully exploited in the United States. While peat can be converted into a fair quality of fuel for both domestic and steam purposes, all methods of handling it so far devised require heavy machinery and considerable hand labor, and both of these are expensive. Several experimental plants have been started to test the feasibility of manufacturing peat fuel, but they have not commenced work on a commercial scale. It is estimated that from 500 to 1,500 tons were produced in 1906. During the year there were imported into the United States 8,557 short tons of peat, valued at $45,344.

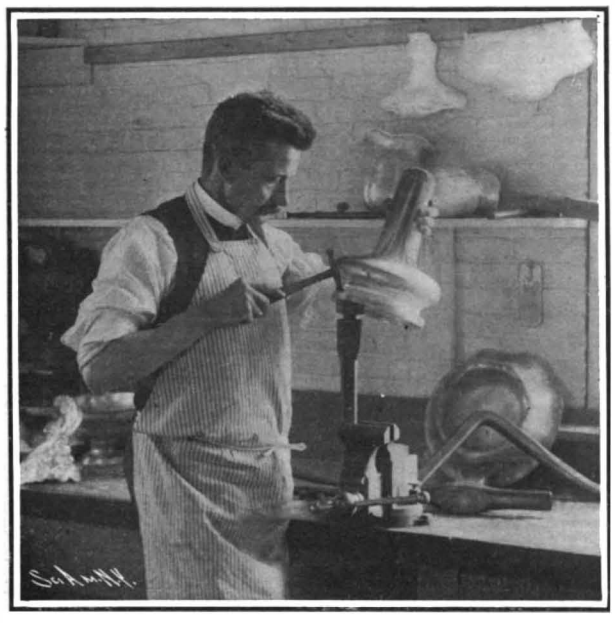
© 1907 SCIENTIFIC AMERICAN, INC.

HOW THE SCIENTIFIC AMERICAN TROPHY WAS MADE.

In the art of the silversmith we have a striking example of the increased demand for skilled labor which follows the introduction of machinery. Innumerable tools have been invented or adapted for the working of precious metals, but at every stage of their work they call for trained hands and alert brains—the tools supplement but do not supplant.

A brief survey of the manufacture, in the workshops of Messrs. Reed & Barton, of the trophy offered by the SCIENTIFIC AMERICAN for flying machines heavier than air, shows that the work has passed through many skilled hands, and that in each case the worker and not the machine has been the dominant factor.

The first designs, embodying the suggestion of the donor, were sketched out by an artist. Sometimes the artist elaborates a design from crude suggestions; oftener he is the creator. The main lines of a design



Hammer Work.

having been decided on, the proportions are carefully studied and the details worked out, in a complete sketch the actual size of the proposed work. From this completed sketch, the artist makes a final drawing in water color, intended to convey as true an idea as possible of the finished work.

The preparatory work of reducing silver to sheet form, though requiring expert skill and care, is in most respects like that bestowed on any of the metals used in the arts, and the processes of melting, rolling, etc., need not be described here.

In the forming or "spinning" of the metal, the sheet is worked over a turned form, or "chuck," in a lathe. An illustration shows the spinning of the sphere of the trophy—a delicate piece of work which calls for the nicest and most accurate touch on the part of the worker. The spinner's chuck is usually turned from a block of carefully seasoned hardwood; but for undercut shapes—such as this sphere—which will not slide off a solid block, the chuck is built up in sections round a core. When the core is withdrawn the sections can be removed, one at a time, through the aperture in the spun metal.

Another illustration shows the silversmith at work on the lower part of the trophy. Hammer work is still the vital factor in shaping silver, for the delicate touch and control of the skilled worker has not been imitated by machinery. Many of the most beautiful examples of silverware are handwrought in this way; and the hammer, with which the art began ages ago, will doubtless continue to hold its place.

The ornamental features of the trophy were worked directly on it by hand, or reproduced from models specially made for it. These models were built up in wax upon the body or form prepared by the silversmith. This process of modeling is identical with the work of the sculptor who reproduces his models in marble or bronze, and it requires an equal amount of artistic knowledge and skill, in addition to a special knowledge of the technicalities of silver working. The modeler bestows much thought and care on his work, frequently finding it necessary to modify or even change the original design. What looks well in a water-color sketch may not be satisfactory when developed in mass, but may require the accentuating of some features and the subduing of others before a pleasing effect can be secured. When the wax model is completed, a plaster cast is taken, and carefully finished to serve as a pattern for the molder, who reproduces the model in metal by casting.

Casting is delicate work; some of the fine sands from which the molds are made are imported from Europe. These, after being accurately prepared, are tamped into iron frames around the plaster model. When a sharp mold is obtained, the frames are clamped together, dried, and the molten metal run in. With suitable sand and careful manipulation, exceedingly fine castings are secured.

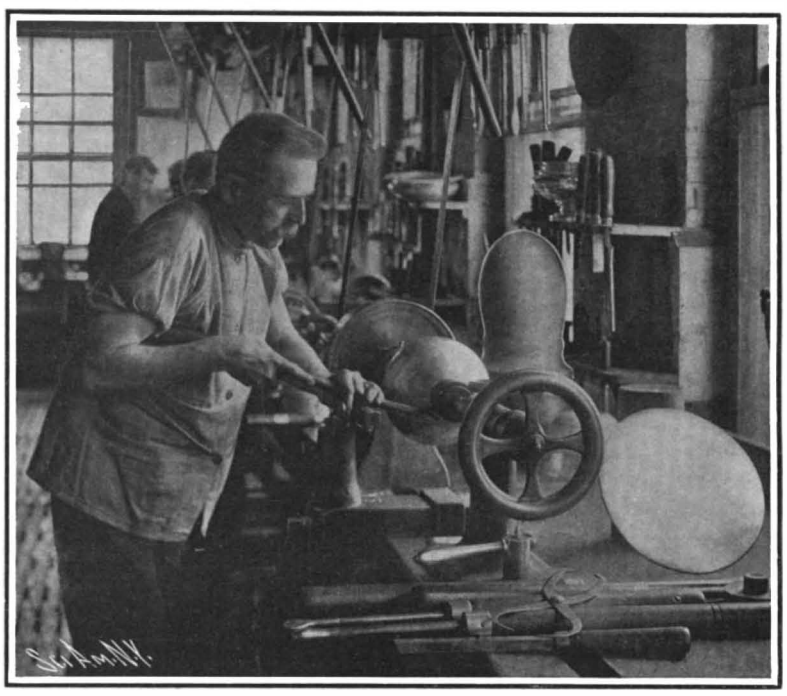
The trophy is a fine example of the work of the chaser, and an illustration shows three men at work on various portions of the piece.

In the chasing of cast or sheet-metal work, a multitude of small tools are required—tiny chisels, punches, and riffles for cutting, hammering, or scraping the surface according to the texture desired. In *repoussé* work, where the metal has first to be raised or "snarled," this is done with a snarling iron—a hammer, which may be inserted in a hollow body, and by a sucession of rapid taps force the metal to rise or bulge out. During the snarling, the metal body is held by the operator, who guides it to obtain the raised pattern just where needed. The raised body is filled with a composition stiffening, which prevents any general sinking while yielding at any special point. The detail of the design is then tapped out on these bulges, by means of tiny punches.

When the spun, hammered, and cast portions of the trophy were chased, the several parts were assembled for soldering together. In soldering, a clean gas flame is used with the ordinary air pressure blowpipe. The portions to be joined having been accurately fitted are scraped clean at the points of contact, fluxed with borax, heated to the requisite temperature, and touched with a thin rod of solder, which should instantly flush the seam. A perfect

Finishing the Original Sketch.

solder joint is practically invisible, and is as strong as the metal itself. The making of a trophy necessitates a perfect cooperation among the workers engaged on it. Each individual must be skilled in his own department, and his work must dovetail in with that preceding and succeeding him. A weak link at any stage will be revealed in the final result. To produce a perfectly satisfactory trophy, such as this one, betokens not only a staff of skilled workers, but a well-organized workshop and men whose hearts are in their work. The trophy is on exhibition for a short time in the showrooms of Messrs. Reed & Barton, 32d Street and Fifth Avenue, New York city, where it is attracting much attention.



"Spinning" the Sphere.

HOW THE SCIENTIFIC AMERICAN TROPHY WAS MADE.

Foreign Apples in Great Britain.

A report from Consul F. W. Mahin, at Nottingham, states that official figures show that Great Britain's annual import of apples is now nearly 9,000,000 bushels. One-half the import is from the United States. The total from all the British possessions is under 4,000,000 bushels; Canada's share is about 3,000,000, and Australasia's nearly 500,000. The import from all foreign countries other than the United States is therefore small. The favorite apples in the British market are certain kinds from the United States, but it is believed that the entire demand for imported apples could be met by Canada and Australasia.

FOOD VALUE OF DRIED FRUITS.

BY SIR FRANCIS HENRY LAKING, M.D., PHYSICIAN TO THE KING OF ENGLAND.

It is to be regretted that an economical and valuable article of food, in the shape of the dried currant, should be so much neglected. The dietetic value of the fruit is misunderstood and the prejudice against it entirely unjustified. Properly prepared, the currant might, with the greatest advantage, form an every-day item in the meals of the people, who seem to choose their food and arrange their dishes with an ignorance the extent of which is appalling. If people could be taught a few simple facts about the worth of various kinds of food commonly eaten, I am of opinion that much benefit would result. If some elementary knowledge of the chemical components of food could be imparted to the masses, I feel sure that our race would be healthier, more vigorous and better equipped to resist the attacks of disease.

Imagine what would be the benefit, if the toilers could be induced to master and act upon the fact that food, to be perfect, must contain in the proper proportions the three main elements—nitrogenous substances, carbohydrates, and fats. It should not be difficult, say, to popularize more extensively an inquiry into the meaning of "proteids"—that they are, in fact, the albuminous fundamental and principal constituents of the animal body; that food accurately abundant in proteid makes for the building of tissue and the making of muscle. The meaning of the word "carbohydrates" should not be incapable of demonstration in popular language; nor should the importance of the proper balance of the sugar in the food be difficult to explain in a manner intelligible to the people.

From recent analyses of samples of dried currants the fact has been verified that the fruit contains no less than 73 per cent of sugar in its most valuable form. This great saccharic proportion is already in the shape of grape sugar, and thus is potential to take up its work of producing and maintaining energy and vitality. It is what is known as "invert" sugar, a composite of dextrose and levulose. It assists digestion; it allays nervous excitement, and provides nourishment in case of nervous exhaustion. No fruit can show this large proportion except those of and kindred with the currant.

I wish it could be more generally realized that, in selecting articles of food to supply the constituents of normal diet, regard should be had to the amount of potential energy in the material. It should be an easy matter to convince the people that this or that food is good or bad—that certain things are abundant or deficient in essential food elements.

For instance, let us make an interesting comparison, and one that should be quite clear to the average intelligence: I mean the comparison between the components of currants and lean beef. The currants show 73 per cent of grape sugar, the whole of which contributes to manufacture energy; the beef contains no sugar at all. Currants contain 1.77 per cent of proteid; the beef 19.3 per cent. In currants there is but 20 per cent water; in beef 72 per cent, the bulk of which is waste. Lean beef con-

© 1907 SCIENTIFIC AMERICAN, INC.

tains but 0.6 per cent more heat-producing material than currants, the figures of which as regards fat stand at 3 per cent. These figures referring to the currants are taken from a recent analysis by E. F. Harrison, B.Sc. (Lond.) F.I.C., Ph.C., F.C.S. The figures for the beef are extracted from a table of food values compiled upon the researches of such authorities as Church, Payer, Letheby, Blyth, Pavy, Holbrook, Oldfield, Kress, and others. The result is the disclosure of the important fact that there is no less than 54.87 per cent more total nutriment in the currants than in the beef. The point might be advanced that the currants show a low proportion of proteid, but the people should be warned against the dietetic error of using food containing an excess of proteid. They should also be taught how to supplement any deficiency in the various modes of preparing the fruit for table. They should be shown with what ingredients to mix it, so that it may contribute its powerful assistance in building and maintaining the body. Indeed, I am not wide of the mark when I say that, even eaten alone, the currant contains nutriment in all sufficiency.

In the dietary of the peasant classes of Greece, a people remarkable for their hardihood and health, the currant appears at almost every meal, while in Germany and Holland currant bread is a common article of food; indeed, among the many shapes in which the currant may be brought to table, a bread made of say thirty parts of currants to seventy parts of dough is one of the best.

Currants contain in the right proportion certain valuable acids such as tartaric, citric, and malic. These acids, while having wholesome individual properties, besides being refrigerant, antiseptic, and antifebrile, serve to modify or adjust the flavor of the sugar and help the other nutriment components of the fruit to readily deliver themselves up. It will thus be seen that the toiling and insufficiently fed masses have at their command a delicious article of food which costs the merest trifle and of which they would surely and readily avail themselves did they but know its value. The middle and upper classes, those who are in a sense indifferent to food regarded in its dietetic aspect, but who select it mainly for flavor, have an important adjunct to the table, which gratifies the palate and operates as a liberal auxiliary to health and well-being.

Now a word as to the prejudice against currants. It is a fact, generally overlooked, that the desire to quickly obtain the flavor of food which is particularly acceptable to the palate, has a tendency to induce hurried and incomplete mastication. To obviate this neglect and to obtain the best results, it is important that the skin of the fruit should be broken. The delicious flavor of currants develops in a most marked degree by the act of chewing, and carelessness in this respect is a great loss to the eater.

The splendid varieties of currants grown in the district of Vostizza, and intended to be eaten as dessert, either alone, with almonds, or with any other kind of nuts, are shade-dried, seedless, as indeed all currants are seedless, and of a velvety softness. For children and those who must of necessity adopt a "diet" currants properly treated and prepared will prove a digestive aid and act as a gentle and natural laxative. Therefore, any accusation against this delicious economical and valuable little fruit must fall to the ground as absurd.

Deutschmann's Yeast Serum.

Prof. Deutschmann of Hamburg has opened a new field of serum therapeutics by his researches, which were undertaken for the purpose of obtaining a single serum applicable to the treatment of all germ diseases, both local and constitutional. Deutschmann's serum has the additional peculiarity that it neither produces immunity from infection nor generates antitoxins but simply aids and strengthens the cells of the body in their conflict with disease germs. Microbes of many kinds find daily and hourly entrance into the bodies of men and animals and the issue of the conflict between pathogenic microbes and the cells of the body depends upon the health of the latter. If the body cells are victorious only slight and transitory impairment of health results, but if they succumb to the invaders we have a case of typhoid, cholera, pneumonia, blood poisoning, etc., according to the species of the disease germs. As a rule, healthy bodies successfully resist the attacks of most of these invaders, and Deutschmann's search was for a serum which would confer the resistance of normal, or rather of ideal health, upon a body attacked by zymotic disease.

He obtained such a serum from the blood of healthy animals to which gradually increasing doses of common yeast had been administered, in their food. Yeast has recently been employed with good results in the treatment of carbuncles and contagious local catarrhs. As yeast does not kill bacteria, Deutschmann evidently assumed that it acts by promoting the natural formation of remedial or protective substances in the organisms. These protective substances differ from antitoxins in that they neutralize or destroy all germs, not merely germs of one kind.

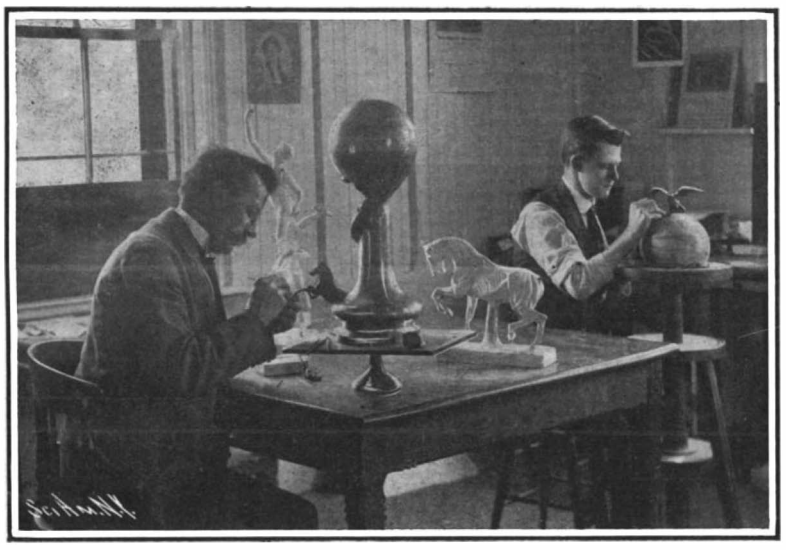
The serum of the animal, which contains these substances, can then be extracted and administered to human patients. The human organism can itself elaborate these substances under the stimulation of gradually increasing doses of yeast, as appears from the successful employment of this treatment in carbuncles, etc., but it cannot do so effectively when it is already seriously diseased. Hence the advantage of the indirect treatment, using the blood serum of a healthy animal that has been dosed with yeast.

The direct administration of large quantities of yeast has an injurious effect, particularly in febrile conditions. (The writer is contemplating a series of experiments on the administration of other remedies by this indirect method.) Deutschmann had in view chiefly the treatment of infectious diseases of the eye and in the Munich Medizinische Wochenschrift (No. 19, 1907) he reports a number of severe cases, from his practice as an oculist, which were completely cured by the serum, without any other treatment.

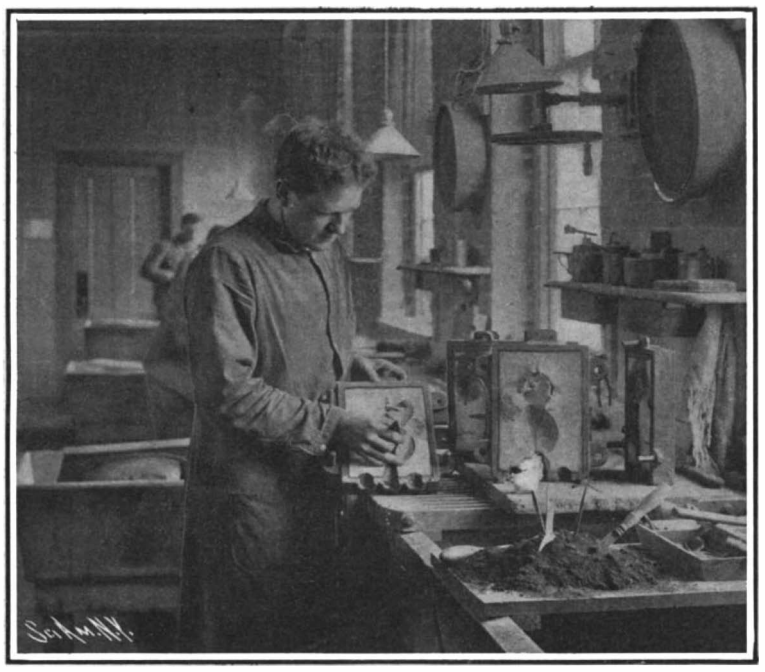
The serum, however, has been found equally effective in a variety of zymotic diseases. Prof. Deneshi has employed it with success in twenty-four cases of pneumonia. The writer has used it with astonishing results in five cases of contagious sore throat. In each case a single injection of one or two cubic centimeters of the serum brought down the temperature immediately and a cure was quickly effected.

Of cases reported by other physicians I shall mention only the most remarkable—a case of puerperal fever complicated with pneumonia which was cured by a few large doses of serum.

It is too early to pronounce a final verdict on the merits of Deutschmann's yeast serum, but it is evident from the results already obtained that it well deserves the attention of the medical world.—Dr. Friedlieb in Umschau.



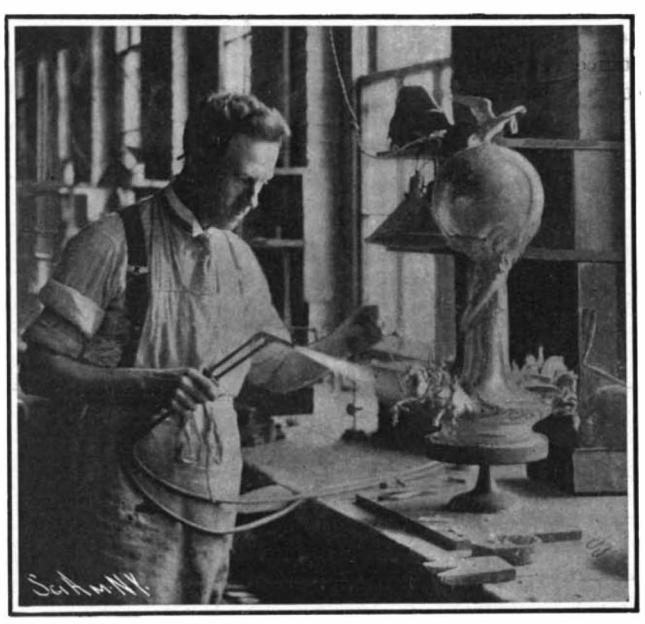
Modeling the Decorations.



The Molder at Work.

A free trade-school has been opened at Grace Chapel, Fourteenth Street and First Avenue, New York, where instruction is given in architectural and mechanical drawing, free-hand, clay modeling, tailoring, bent iron work, electrical fitting, carpentry, millinery, dressmaking and cookery. The classes, which are under the supervision of Mr. Arthur H. Kiewitz, M. E., are held on Monday, Tuesday, and Wednesday nights and on Saturday forenoon.

Chasing and Repoussé Work on the Trophy.



The Final Soldering of the Trophy.

HOW THE SCIENTIFIC AMERICAN TROPHY WAS MADE.

© 1907 SCIENTIFIC AMERICAN, INC.

BY MOTOR CAR TO THE SOUTH POLE.

BY J. S. DUNNET.

At the beginning of next year, E. H. Shackleton will make another attempt to reach the South Pole, leaving New Zealand in January for that purpose.

The party of twelve will embark in a ten-knot steamer, not specially built to resist the ice packs, for she will return to New Zealand as soon as she has landed the expedition, with a liberal quantity of supplies. After wintering at a convenient spot, the work of exploration proper will begin during the following October. The expedition will be divided into three sections. One will travel eastward, and cross the barrier in the hope of reaching the area known as Edward the Seventh's land, and follow the coast line southward, retracing its steps when necessary. The second detachment will strike south over the same route followed by the "Discovery's" sledge party in 1892. The third will go in a westerly direction over the mountains toward the magnetic pole. Each party will be equipped with a motor car, specially built for the purpose. The sledges containing provisions and paraphernalia will be hitched to the car. As a stand-by, Siberian ponies will be used instead of dogs, as employed in the 1901-4 expedition. It is claimed that these animals will easily drag a load of 1,800 pounds on a food basis of 10 pounds per day, while a dog will only conveniently shift a load of 100 pounds on a 2-pound per day ration. Thus one pony will equal as a carrier 18 dogs at less than one-third the aggregate food allowance. Besides that, the pony can comfortably sledge a distance of 20 to 25 miles a day on a pinch, a thing the dog has never been able to do.

It is expected by Shackleton that the party will be able to cover up to 25 miles per day. If the motor-car aid reaches his expectations, he feels sure he will be able to get beyond latitude 82 deg. south. At every 100 miles of the journey a sledge will be left containing provisions, in case of any accident. The winter quarters will be at Mount Melbourne, the highest known point of the dark continent. At that spot they will be 731 miles from the pole; and assuming that the motor cars carry them beyond latitude 82 deg. south, they would then be starting on the remaining 464 miles as fresh as if they were starting from the ship's side. Shackleton thinks they can follow the trend of the southern mountains a long distance before needing to turn east or west. Should it be necessary to veer east, and they find it impossible to surmount the glacier fields with the car, they can resort to the method of pulling the sledges up with the ponies. If that expedient is impracticable, they may go eastward until they find it necessary to return to winter quarters at Mount Melbourne. But if, on the other hand, the mountains turn to the west, they could go due south, increasing the distance between their depots to 150 miles, to admit of a more extended journey. If the pole area be reached, they could then strike at an angle about northeast, picking up the mountains to the west.

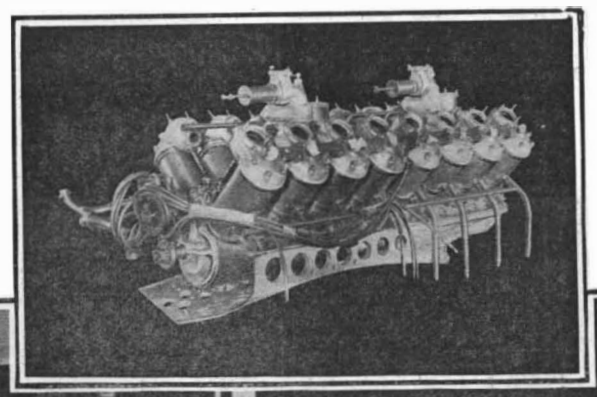
It is not proposed during the expedition to neglect the biological, meteorological, geological, and magnetic work commenced by the "Discovery." If possible, a small party will be landed at the nearest available point to the magnetic poles. There it will remain until the time comes for sledging, when it will travel across the mountains to take full observations. Should the party reach the pole, the magnetic area will be surveyed as far as possible. While at Mount Melbourne during the long winter everything possible will be done to collect scientific data. The active volcano, Mount Erebus, in the neighborhood, will be investigated. A special attempt will be made to study the habits of the emperor penguin; and with the aid of a cinematograph camera to snap-shot its movements, and a phonograph to record its weird cries, it is hoped to get matter of great interest. Some carrier pigeons will also be liberated, to see if they can put up a world's record by getting back to New Zealand.

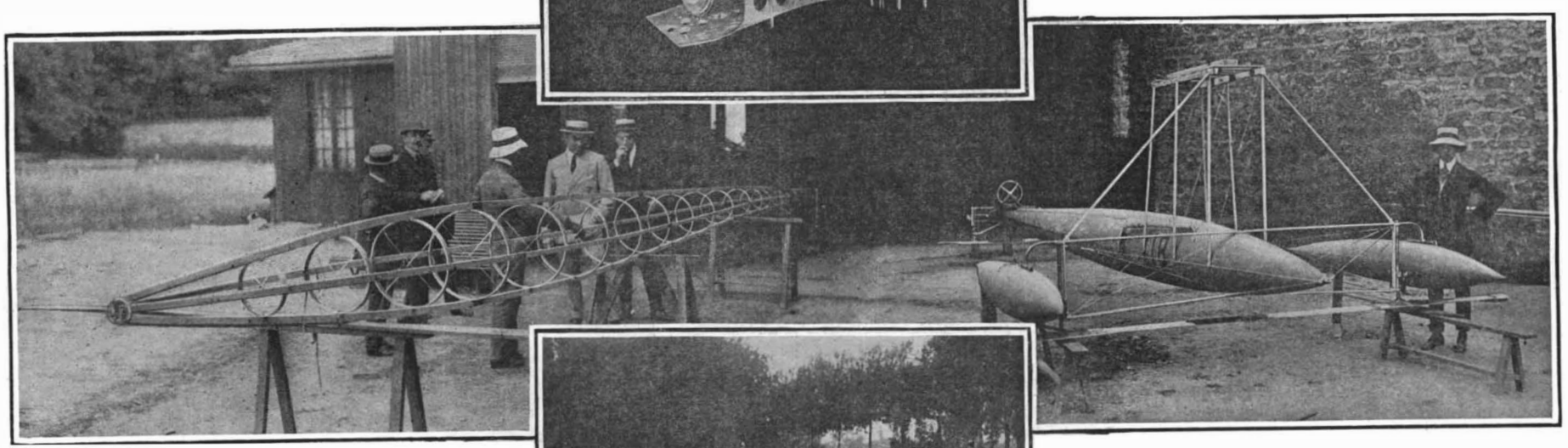
A vessel will be dispatched from New Zealand to pick up the parties in February, 1909. The southernmost section will be picked up first; then the Mount Melbourne party. After that they will steam to the north of Ballemy Islands, keeping in as far as possible in order to trace the coast line of Wilkes Land.

SANTOS DUMONT'S NEW HYDROPLANE.

In an effort to win a ten thousand dollar bet made with M. Charron, to the effect that he could build a hydroplane which would travel 100 kilometers (62 miles) an hour, Santos Dumont has recently constructed the novel craft which we illustrate. This new hydroplane consists of one long cigar-shaped pontoon 10 meters (32.8 feet) in length, and which is placed between two similar smaller floats 1 meter (3.28 feet) long. The three floats are fastened together, and a long, narrow plane, 13.12 feet long, extends crosswise from one of the small outer floats to the other. Another plane 4.92 feet long is placed transversely at the rear. The construction of the apparatus is apparent from the photographs. The floats are built up upon a framework of wood and aluminium covered with a rubber-treated fabric which is air and water tight. They are inflated with compressed air, in order to increase their stability. A 16-cylinder, 120-horse-power, V-type motor is mounted on the framework which carries the air propeller. The motor drives the latter direct. The helmsman sits in a small seat at the rear end of the center float, and steers the hydroplane by means of a wheel. In one of our photographs the new craft is shown being towed at a good speed by a fast motor boat. When this test was made, the hydroplane rose until the floats were completely lifted out of the water, and it glided upon its two planes with apparently good stability. The total weight of the new craft is not much more than 500 pounds. In the test which is soon to be made, Santos Dumont hopes to do better than 100 kilometers (62.13 miles) an hour.

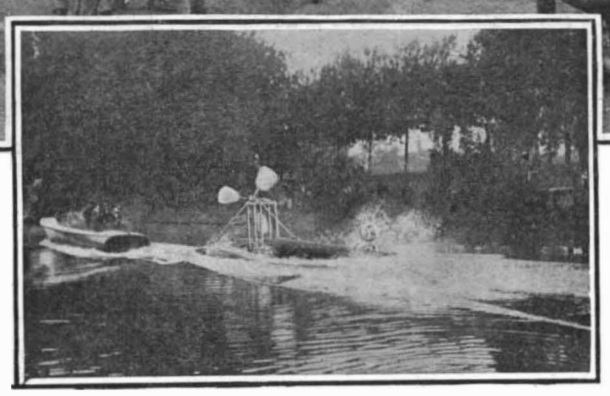
The 120-Horse-Power, 16-Cylinder, V-Type Motor Used on the Hydroplane.





Framework of the Large Float.

The skeleton of the floats is made of wood and aluminium.



Towing Test of Santos Dumont's "No. 18" Hydroplane.

The 3-bladed air propeller will draw the craft.

SANTOS DUMONT'S NEW HYDROPLANE.

The British War Department's new dirigible balloon "Nulli Secundus" on October 5 made a voyage from Farnborough, a suburb of Aldershot, to London. The trip proved in every way successful. Following the highroad, the balloon kept so straight a course that its shadow fell on the road for a great part of the way. The balloon started against a head wind blowing ten miles an hour, but in spite of this it covered the 32 miles between Aldershot and London in a few minutes over two hours. The balloon appeared under perfect control, and whether with or against the wind, it sailed smoothly and swiftly. On reaching London the balloon first circled over the buildings of the War Department and then, curving round St. Paul's Cathedral, journeyed southward to the Crystal Palace, where it descended. The entire trip lasted three and a half hours. Col. Capper says he could have remained up six hours and longer, but thought it inadvisable to take risks at this experimental stage. The event is regarded as marking a new epoch in British military history. The visit of the airship came as a surprise to the authorities at the War Office, although they knew that something of the kind was contemplated at some time or other. All the officers in the building turned out to greet the visitor. It came low enough to afford an excellent view of it. It was possible to see the working of the mechanism. During the three and a half hours' trip, the "Nulli Secundus" covered fifty miles. The highest altitude reached was 1,300 feet. The mean height was 750 feet. The speed was fourteen miles an hour, but at one point it reached forty. The engine, which is of French construction, ran from 1,100 to 1,200 revolutions a minute. Ordinary gasoline was used as fuel. Ballast was carried but not used.

During a recent storm the airship was badly injured because of poor housing. It is questionable whether it will ever sail again.

The Completed Hydroplane.

Note the narrow planes beneath the floats at front and rear.

The Pennsylvania Railroad School of Telegraphy.

A school of telegraphy was opened at Reading, Pa., by the Pennsylvania Railroad on September 16. The supply of well-trained men is at present insufficient, and national legislation limiting the daily work of railway telegraphers to nine hours will enforce upon railway companies the problem of supplying a large number of additional operators. On the Pennsylvania road alone, which now employs more than 3,000 operators, it is estimated that 700 additional men will be needed to comply fully with the provisions of the law. The time required for the course is six to eight months, and salaried positions await graduates. The cost of tuition is $2 monthly—a merely nominal sum. The Pennsylvania Railroad wants healthy young men between the ages of 17 and 25, with a fair knowledge of English, mathematics, and geography—and with brains.

To familiarize students with practical work, the regular wire of the division will run through the school room and standard train order blanks will be furnished. The text books will consist of the book of block signal rules, the book of rules for the government of the transportation department, copies of all standard forms of Pennsylvania Railroad blanks generally used in the keeping of station agents' accounts, and other standard literature used in carrying on the business. In addition to this, students will be instructed in the general duties of an agent in administering the affairs of a station.

The entire frame of the great tower of the Singer building in New York is completed, and the outer walls, which have followed the steelwork closely, are more than three-quarters finished. The framework, which was not started until late in the spring, has been put up in good time and without any serious mishaps. It is expected that the whole of the lofty structure will be inclosed before there is any very cold weather, so that the interior work, which will be entirely fireproof, can proceed without interruption in the winter.

The British Admiralty proposes to arm the new vessels of the "Dreadnought" class with eight new type 13.5-inch guns, so disposed that they can all be fired on either broadside. The new weapon will be over 50 feet long, and a shell from it will, it is calculated, pierce 20-inch Krupp steel armor at a range of 3,000 yards.

© 1907 SCIENTIFIC AMERICAN, INC.

PLANT CULTURE BY ELECTRICITY—AN INTERESTING EXPERIMENT.

BY HAROLD J. SHEPSTONE.

An exceedingly interesting experiment is being conducted at the Royal Botanic Gardens, Regent's Park, London, under the name of "the Thwaites Electric Culture"; and if it bears out under a lengthy trial all the features that the inventor claims, it is likely to revolutionize the present methods employed both in the heating of glasshouses and the manner in which plants and fruits are hastened to maturity independent of the seasons.

Before describing this new system of electric culture, a brief reference to previous experiments will not be without interest. Very soon after Jablockhoff invented the electric arc, it was discovered that the rays from this light stimulated the growth of plants, and the work was continued by Sir W. Siemens in England, Bailey in America, Lebstrom in Sweden, and Berthelot in France. Both Sir W. Siemens and M. Berthelot died before the results of their experiments became known, but they were quite classical and of splendid promise. Bailey was convinced that the arc light promoted assimilation and hastened growth and maturity. Lebstrom found the positive electrostatic current to greatly accelerate the circulation of the sap, and the more fertile the soil the more vigorous the vegetation, and the more effective the current; it was also found to increase the proportion of saccharine.

Coming to the present experiment, we have an ordinary glasshouse in which have been placed some two hundred plants, consisting of geraniums, fuchsias, various kinds of palms, grasses, tomato plants, etc. The plants are being forced by light from an arc lamp, and the house heated in a new and ingenious manner. This apparatus, which is causing much discussion among electricians, consists of a modern producer-gas suction engine coupled to a dynamo. The electric energy developed by this plant is allocated to the feeding of the arc lights in the glasshouse. An electrostatic machine is driven from the gas-engine crank-shaft, and the electricity is discharged by points along the plants to electrify not only the air, but the plants and their roots as well.

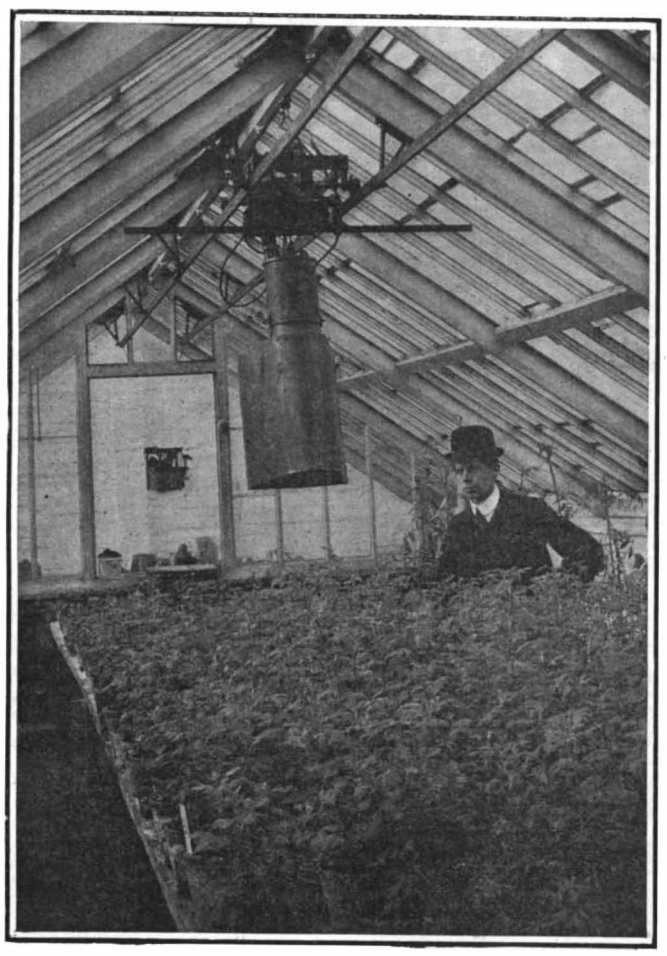
The arc lights are equipped with special reflector hoods, by which the beam of light is confined within narrow limits of concentration. The open end of the hood is closed by a water screen, made up by a glass trough filled with water. This water screen, through which the light rays have to penetrate, is intended to secure as near an imitation of natural solar effect as possible, and to limit the effect of the rays; and if it is desired to screen from the plants any portion of the spectra, colored water can be employed. The roof of the reflector is provided with a chimney, to permit the escape into the roof of the glasshouse of the nitrous oxides that may be produced. It is arranged that the arc lights are automatically constantly and almost imperceptibly moving along the entire length backward and forward of the glasshouse, radiating a powerful beam of light on both sides of the house. The traveler is electrically driven, and the speed may be controlled.

By this plant Mr. B. H. Thwaites, who by the way is a well-known electrician, hopes to secure the six essentials which he regards necessary to force the plant's growth. They are: (1) an ample supply of violet or chemically active rays projected from powerful and moving arc lamps; (2) a supply of electrostatic current for the atmosphere and the roots; (3) an atmosphere containing moisture and carbon dioxide in the proportion common to most fertile countries; (4) a temperature within the limits of 70 and 80 deg. Fahrenheit; (5) an ideal fertilizing agent; (6) an ample supply of water for the roots.

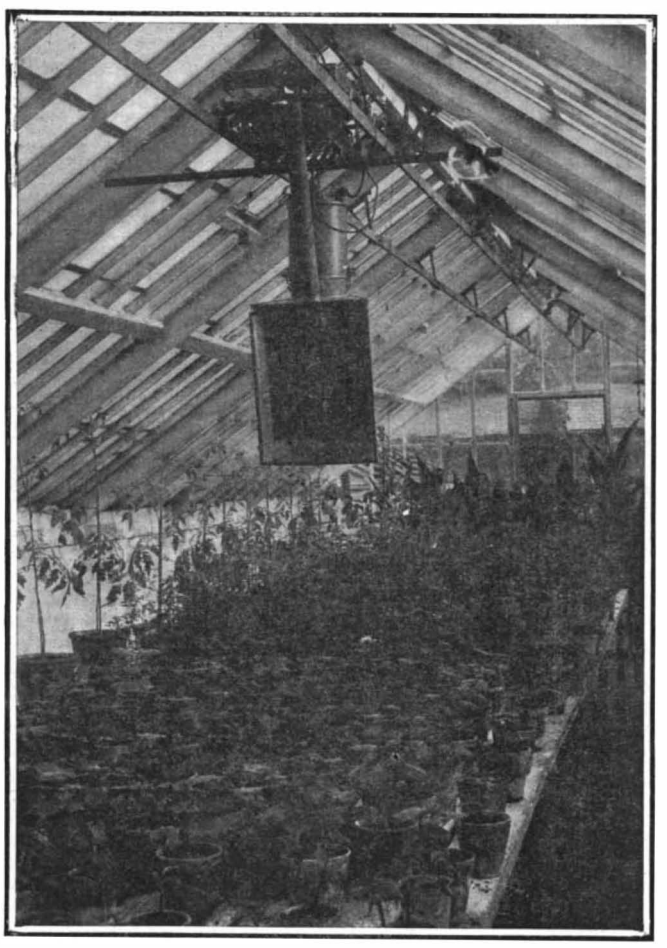
The Two Plants on the Right Have Been Stimulated into a Vigorous Growth by Electric Rays.

It is also the inventor's contention that the apparatus is an economical one. It is expected that the figures will show a saving of thirty per cent over all systems at present employed. Indeed, it is claimed that the whole cost of the apparatus and its working comes out in the end at the rate of two cents, as at present compared with six cents per hour. Then it is an apparatus well within the supervising ability of an ordinary intelligent workman, and can be left for hours together.

At the present time daylight is being extended for a period of four hours. Just before sunset the powerful arc lamps are lighted, and the beam flits from plant to plant as it moves slowly up and down the glasshouse. When the days get shorter, the light will be put in operation for longer periods. Mr. Thwaites estimates that with his system, from three to four producing seasons in the year will be attainable. If, of course, choice fruits and flowers can be produced at any period of the year at no great cost, the invention should certainly possess great commercial value. As already stated, at the moment it is purely in its experimental stage, the plant having only been in working order for just about a month, too short a period for one to predict likely results. At the same time, it is an experiment which will undoubtedly be followed with the greatest interest.



The Rear Side of the Light.



The Front of the Light.

HOW THE ELECTRIC LIGHT IS USED TO STIMULATE PLANT GROWTH.

A Remarkable Acoustic Phenomenon.

An interesting acoustic phenomenon called, in Italy, "brontidi," has been investigated by Prof. T. Alippi, of the meteorological and seismical observatory of Urbino, Italy. These brontidi are mostly hollow noises, resembling the echo of a distant explosion, and are usually observed with a bright sky and calm air, occurring rather seldom in windy or rainy weather. They usually occur in the afternoon, both in winter and summer. These noises would seem to be of atmospheric origin. They do not produce any physiological effects of their own, nor do they seem to be connected with local earthquakes, though they sometimes cause window panes to vibrate. They are nearly everywhere considered as presage of bad weather, and are popularly supposed to be due to strong tides or storms at sea, whose echoes are transmitted to a distance. Prof. Alippi has obtained his results by means of a circular letter to which 217 observers have replied, and 135 of whom had noticed the sounds. The observers in question were distributed throughout the whole of Italy and its African colonies.

These noises do not appear to be due to artificial causes, such as mine explosions or gun shots, as they mostly occur in central mountain regions, where such causes are absent, while in some populated valleys where mines are common their existence is never noticed. The author is not inclined either to ascribe this phenomenon to natural causes, such as winds, while the hypothesis sometimes suggested of thunderbolts under the horizon cannot be maintained either, owing to the equal distribution of brontidi over summer and winter.

There may be some connection between certain brontidi and seismical phenomena, while another class of brontidi may be connected with meteorological phenomena; and in order fully to elucidate this question, the observations will be continued from the Italian Central Meteorological and Geodynamical Office, which intends to send out more inquiry forms.

Damsite is the name of a new town in Texas, recently included in the list of post offices. It is a village located on the 10,000-acre farm of Col. Cecil Lyon and associates in the Texas Panhandle. They have their own system of irrigation, and are not selling the land, but will cultivate it, employing about 200 farm hands. A commissary store is conducted as a part of the farm enterprise, and a large amusement hall has just been finished. The aim is to make Damsite a model community.

© 1907 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

HOE OR RAKE HANDLE CONNECTION.—C. B. BENDLAGE, Marshalltown, Iowa. The object of the inventor is to provide an interchangeable handle which may be applied to the heads of hoes, rakes, etc. A further object is to provide a handle to which the head of the desired implement may be applied in various positions, according to the nature of the work to be done. The handle is adapted to be quickly attached or detached from the implement head.

GRIT FOOD FOR FOWLS.—E. J. FUCHS, Scranton, Pa. The product contains valuable nutritive elements suitable for fowls, and also elements necessary for the sustenance of hens engaged in laying eggs. It is largely insoluble in water, but under the action of the powerful digestive fluids, it is assimilated to considerable extent, and the part not thus assimilated remains hard and glassy. That portion which does not serve as a food and egg builder, serves as a grit, so necessary for the welfare of fowls.

Of General Interest.

METHOD OF UTILIZING HILLSIDES AND MOUNTAINS.—M. RICHTER, Williamstown, W. Va. The invention consists in forming the hillside into a succession of series of shallow basins adapted to hold and retain the precipitation of water and planting in each basin a growing tree, the growth being greatly promoted by the retained volume of water held in the basin, each descending series of trees having its individual basins alternating with basins of the series above, or being staggered or placed so that the lines of quickest descent do not coincide in the adjacent series.

SPONGE-HOLDER.—U. L. RIFE, Sound Beach, Conn. The device is for use in holding sponges, cloths, or other articles, with which it is desired to wash or wipe windows or other objects not readily reached by the hand, and the object of the inventor is to provide a device easy to manipulate and capable of gripping articles as tightly as desired, and from which they may be instantly removed when desired.

Machines and Mechanical Devices.

BISCUIT-CUTTER.—L. A. ROCKWELL, New York, N. Y. The invention relates to improvements in devices for cutting or forming biscuits from sheets of dough, the object being to provide a cutter and die by means of which the dough may be evenly cut with a clear and smooth figure impressed thereon; and further to provide means for ejecting the formed biscuits from the cutters.

GAGE.—J. J. ROBINSON, Bloomsburg, Pa. The gage is for use in connection with saws and other woodworking machinery. The invention provides an accurate and readily manipulated gage apparatus. A carrier-screw serves to determine the position of the gage members, since a movement over any number of threads will effect a known advance. Furthermore, by the use of a threaded carrier, ease of rotation of the gage members is secured, while they are at the same time retained against longitudinal movement upon the carrier.

SCREW-THREADING MACHINE.—F. H. MCLAIN, Stratton, Me. The objects of the invention are to construct a practical machine which shall be automatic in its action of feeding wooden boxes and covers or other blanks, from a receptacle chucking them between the jaws of a suitable chuck, cutting the thread thereon and ejecting them from the chuck with no other labor required than simply placing the boxes in the receptacle.

CALCULATOR.—E. LEDER, Rixdorf, near Berlin, Germany. The operation is simple. It comprises a keyboard for one figure or quantity, a slide keyboard for another figure or quantity, a plurality of slides movable between the keyboard and the slide keyboard and each provided with a pair of rollers having various series of teeth on their peripheries, a carriage movable over the slides and containing an operameter adapted to be operated by the roller teeth, a mechanism controlled from the keyboard for adjusting the slides, and a hand-crank with mechanism for adjusting dials in the operameter.

CLUTCH-OPERATING MECHANISM. — J. P. KARR and J. D. RAUCH, Logansport, Ind. A mechanism is produced in which the construction is simplified, friction in adjusting the movable clutch members is reduced, and the separation of the clutch members may be effected instantly under all conditions. The invention also provides for varying the throw and rotation of the twin screws as may be required to take up wear.

PROPELLER.—A. H. FRIEDEL, Cleveland, Ohio. Certain improvements are made by this invention in propellers adapted for use in connection with water or aerial navigation, and the invention relates more particularly to means for supporting the blades and varying the angles thereof in respect to the propeller shaft, whereby the speed of the vessel may be readily controlled or direction reversed without the necessity of speed-changing reversing gears.

CARVING-MACHINE.—M. A. CUMING, New York, N. Y. Among the objects of the invention are: To provide a machine with upper and lower decks, the former being for supporting the block to be shaped, the model block being separated upon the lower deck. To place the decks in such position as to occupy comparatively small floor space. It relates more particularly to a machine of a type particularly suitable for duplicating blocks, brims, or curls upon which hats are formed and finished.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10628) N. W. asks how to color copper chocolate by oxidation. A. Take about a tablespoonful of crystallized verdigris and dissolve it in ¼ liter of boiling water. Take also a piece of sal-ammoniac about the size of a nut and dissolve it likewise in ¼ liter of water. Now pour the two solutions together and add ¼ liter of wine vinegar. Boil well together and filter. Of the filtrate now take about a wineglassful and just before using it add to it a teaspoonful of ammonium sulphide. The copper object to be colored must be perfectly clean and polished. The solution may be applied with a hair brush and dried in a warm oven. To assure the sticking of the oxidizing fluid, a sort of binder must be added, and for this purpose a little rouge will do. The liquid should be very evenly applied and dried slowly. After each application of the liquid it must be seen to that the old coat, which has dried in, is completely dissolved in the new, otherwise spots will arise. Six or even ten coats being thus applied, the pot may be washed in warm water and dried. Heat the article now slowly, whereupon it becomes considerably darker. If the required color has not yet been reached, the painting process must be repeated and the object again heated until the tint is reached.

(10629) S. E. asks: 1. What electrolyte is commonly used in an electrolytic rectifier employing copper and aluminium electrodes? A. Any salt may be used in an electrolytic rectifier which will readily oxidize aluminium. Sodium acid phosphate is good for the purpose. A full description of a lead-aluminium rectifier may be had from our SUPPLEMENT No. 1644, price 10 cents. By this apparatus the direct current may be drawn at 7 volts, 20 volts, or 45 volts. Another rectifier, yielding 3 to 5 amperes at 15 to 25 volts, is described in the SCIENTIFIC AMERICAN, vol. 97, No. 8. We send this for 10 cents. 2. Has this phenomenon (the covering of one electrode with a high resistance film) been observed, using other elements as electrode and correspondingly different electrolyte? A. The metal commonly employed for the electrode to be oxidized is aluminium; the other electrode is usually lead. 3. I wish to plate a small piece of platinum with aluminium; what aluminium compound is it advisable to use? A. Plating with aluminium is, we suppose, possible, but is not in commercial use, so far as we know. We have no formulas which we can say will certainly give a good result. Many formulas have been published, but we have no personal knowledge of their working qualities.

(10630) R. F. M. writes: Our 24-horse-power engine propeller jammed against a pier recently and became twisted. We are unable to restore it to the proper position to drive the boat at its former speed, and I wish you would tell me how to set or pitch the 24-inch blades to the best advantage. A. From so brief a description we are unable to judge what may be the nature of the accident to the propeller. "Twisted" may mean that the shaft is bent and the whole propeller out of its true plane, which can be most readily noticed in watching the rotation of the propeller, and easily corrected by straightening the shaft; or it may mean that one or more of the blades is distorted, in which case it should be shaped as nearly as possible to the form of the undistorted blades. To give only the formula most likely to be applicable for plotting the pitch and other curves of the various possible forms of screw would take more space than our Notes and Queries column contains, and it requires education and appliances to plot the curves from the formula or to shape the propeller to the plotted curves. We would refer you to special articles in our SUPPLEMENT Nos. 16, 93, 101, 145, 370, and 800, especially to the two latter, or to "Screw Propellers and Marine Propulsion," by I. McK. Chase ($3), which we can supply.

NEW BOOKS, ETC.

AIR CURRENTS AND THE LAWS OF VENTILATION. Lectures on the Physics of the Ventilation of Buildings Delivered in the University of Cambridge in the Lent Term. By W. N. Shaw. Cambridge: University Press, 1903. 8vo.; cloth; 94 pages; illustrated. Price, $1.25.

In the many practical attempts to solve the question of ventilation too little attention has been paid to the laws of physics. Chemists have deduced from their analyses the limits of respirable impurity in air, and much has been written upon the thermometer as an indicator of healthful conditions, but no one has yet told how a flow of air may be best made to perform the work required of it. Mr. Shaw embodies in this volume the gist of the lectures delivered by him during the year 1903, before the University of Cambridge. He regards the problems largely from the analogy of the distribution of an electrical current in a network of conductors. He lays great stress upon the physics of ventilated space. Wherever it is possible results are expressed in the form of formulæ, so as to be most readily available for practical work.

STATIONARY ENGINEERING. By Joseph G. Branch. A Reference and Textbook written expressly for Stationary Engineers and Firemen. With 300 illustrations. St. Louis: Perrin & Smith Printing Company. 12mo.; cloth; 940 pages. Price, $3.50.

Owing to the varied requirements of modern power plants, and the high boiler pressures necessary for the operation of modern expansion engines and turbines, the responsibility of the stationary engineer has been vastly increased in the last few years. When we further consider that many plants now generate their own power for the operation of their lights, motors, or elevators, and also do their own refrigerating, it can be seen that the modern stationary engineer must not only be a steam engineer, but an electrical and refrigerating engineer as well. This book presents in a compact form the principles which underlie a thorough knowledge of power and heating plants, together with such data on the subject of mechanical and electrical engineering as is deemed essential to the successful operation of power and heating plants of every description. The subjects are treated in a practical way rather than in a theoretical and mathematical manner. Before dealing with the function of any machine, the nature and use of the principal parts are described. The great number of clear designs aids materially the understanding of the text.

ALLAN ON THE DROUGHT ANTIDOTE FOR THE NORTHWEST, N. S. W. By Percy Allan. Read before the Sydney University Engineering Society, October 10, 1906.

An account of the artesian wells of New South Wales, and of the methods of using their waters for irrigation purposes. The drilling of wells and the details of procedure to insure efficient distribution are both described.

INDEX OF INVENTIONS

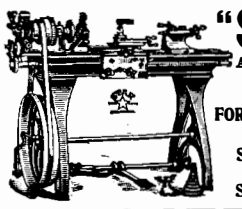
For which Letters Patent of the United States were Issued for the Week Ending October 8, 1907.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Accounting appliance, credit, A. Stevens.. 867,617
Acid, reducing formic, Ellis & McElroy.... 867,575
Advertising and illuminating device, J. E. Auclair 867,564
Aluminium nitrids, producing, O. Serpek.. 867,615
Ash can, C. J. Sussman..... 867,683
Assorting device, J. H. Rand..... 867,599
Automobile attachment, H. J. Carr..... 867,790
Baling press, H. B. Trout..... 867,767
Barrel rinser, S. C. O. Berg..... 867,568
Bed, extension, A. C. Hamilton..... 867,820
Bed, hospital, A. G. Elo 867,712
Bed rest attachment, E. Elbert 867,647
Beds, operating mechanism for portable dump, G. E. Everett..... 867,649
Beehive, W. Beeson 867,636
Beehive, F. G. Marbach 867,891
Beehive, L. H. Keseler 867,919
Belt and appliances therefor, electric, M. Hatzenbuehler 867,721
Binder, Copeland & Chatterson..... 867,706
Blue printing frame, J. A. Bried..... 867,698
Book, loose leaf, W. H. Garland..... 867,815
Book, manifolding sales, A. L. Schultz.... 867,610
Bottle stopper and stoppered bottle, F. E. Clark 867,703, 867,793
Brick drying apparatus, J. C. Boss..... 867,872
Broom holder, T. Brennan..... 867,787
Buckle, belt, B. F. Boyden..... 867,638
Burner. See Gas burner.
Butter and analogous substances, molder and cutter for, A. W. Ward..... 867,772
Button, F. P. Pfleghar 867,924
Calender roller, H. Bostell 867,908
Cam, adjustable, J. P. Hedstrom..... 867,724
Cans, machine for applying identifying marks to, E. H. Sawyer 867,928
Cant hook, W. A. Wood 867,630
Capping apparatus, G. W. Lynn 867,890
Car, convertible railway, M. P. Henvis.... 867,917
Car coupling, Rado & Kerekes..... 867,753
Car, dumping, Henvis & Clark..... 867,726
Car, photographer's, J. Schmidt..... 867,608
Car replacer, automatic, J. W. Walls..... 867,857
Cars, device for operating air cocks on air brake, A. Fravor 867,718
Carbureter, W. F. Rothe 867,604
Carbureter, Weinat & Bogey 867,859
Carding machine, Robinson & Bates..... 867,837
Carriage door locking device, A. Nathan... 867,747
Carving machine, F. H. Richards..... 867,602
Casting copper, mold for, F. L. Antisell... 867,692
Castings, machine for removing gates and risers from, R. O. Jones 867,884
Cement worker's tool, F. W. Grundmann.. 867,819
Centrifugal separator, R. F. Cordero..... 867,800
Check holder, W. R. Clark 867,794
Chimney cowl, A. H. Holtzinger..... 867,881
Chute for endless rope transporting appliances, G. Leue 867,584
Cigar machine, T. Moesinger 867,825
Clasp, E. Gutmann 867,655
Clockwork for recording instruments, F. A. Jones 867,732
Clothes drier, T. Ditmanson..... 867,646
Clothes washer, I. D. Buck 867,873
Cock, gas, E. L. Claus 867,571
Cock, stop and waste, C. S. Frishmuth.... 867,651
Coin collector, E. B. Craft 867,707
Coin collector, J. L. McQuarrie 867,746
Concrete arches, reinforcement for, M. A. Abbott 867,776
Concrete jetty, reinforced, W. C. Cottrell.. 867,802
Concrete pavements, device for laying, G. W. & G. F. Switzer 867,852
Concrete step, reinforced, G. M. Graham... 867,818
Concrete structure, reinforced, C. Mankedick 867,665
Condenser, O. A. Nenninger 867,833
Controller, automatic accelerating, A. C. Eastwood 867,810
Controller, series parallel, A. C. Eastwood.. 867,809
Conveyer system, C. Merritt 867,739
Cooker, automatic steam, W. H. Johnson.. 867,660
Copy holder, E. B. Duke 867,808
Core supporting frame, M. D. Waldron.... 867,688
Core, wire barb mold, F. L. Antisell..... 867,693
Cork cutting and tapering machine, Hellstrom & Exler 867,822
Crate, collapsible, B. F. Lewis..... 867,889
Cultivator harrow attachment, A. A. Yackee 867,865
Current motor, water, H. W. Schmidt..... 867,843
Curtain fixture, D. E. Bonner..... 867,569
Curtain fixture, H. M. Sturgis 867,850
Curtain pole, L. H. Pfleghardt 867,750
Cycle, motor and other, J. L. Miller..... 867,668
D-handle, F. P. Maus 867,667
Dehorner, G. Anderson 867,779
Derrick, portable, W. C. Booz 867,695
Disk feeding machine, A. H. Neureuther... 867,834
Display rack, R. E. Martin 867,738
Display rack, F. H. Corwin 867,801
Diver's helmet, P. Hansen 867,719
Domestic boiler, P. Rahm 867,598
Door, F. A. Lang 867,888
Door check, J. V. Edgcomb 867,811
Door hanger and roller support for edgewise movable doors, D. Schuyler 867,612
Draft regulator, automatic, S. W. Salmon. 867,839
Draft rigging, G. L. Harvey 867,720
Dredging machine, G. M. Brown 867,788
Dress case, E. H. L. Wallace 867,771
Dress shield, M. H. McMann..... 867,830
Drier. See Clothes drier.
Drinking fountain, J. F. Tannehill..... 867,621
Drumhead, I. H. Sapp 867,675
Dye and making same, halogenated red vat, G. Engi 867,715
Dye and making same, red-violet vat, Schmidt & Bertram 867,679
Dye, making a halogenated red, G. Engi.... 867,714
Egg boiler, automatic, C. B. Martin..... 867,921
Electric conductor, Hoopes & Robertson.... 867,659
Electric conductors, making, Hoopes & Robertson 867,658
Electric controlling mechanism, thermo, H. C. Smith 867,846
Electrical condenser, L. Gerard 867,579
Electrolier hanger, R. T. Watt..... 867,858
Elevating device, P. Burnah 867,640
Elevator door lock, G. R. Wikander..... 867,626
Engine igniter, internal combustion, F. E. Ream 867,755
Engine igniting means, explosive, B. Botkowski 867,696
Engine regulating apparatus, internal combustion, J. E. Aue 867,565
Engine starter, C. J. Coleman.... 867,796, 867,797
Engine starter, automatic, C. J. Coleman.. 867,795
Engines, automatic stopping device for internal combustion, D. B. Adams..... 867,899
Explosive engine, revolving piston, A. Bayer 867,782
Eyeglasses, W. L. Breath 867,910
Fan, O. Selg 867,680
Fan and pump wheel, centrifugal, G. M. Capell 867,874
Fan, electric, Diehl & Becker 867,914
Fare and distance indicators, means for operating, O. Kuntzen 867,887
Fare indicator, B. Schneider 867,609
Fare register, W. I. Ohmer 867,592
Faucet protector, G. H. Korner 867,663
Fence, C. I. Saunders 867,759
File pocket, vertical, A. Bushnell, Jr..... 867,789
Filter, G. Knock 867,734
Filters, packing, G. Knock 867,733
Fire alarm, automatic, C. Smith..... 867,681
Fire escape, J. Wenig 867,689
Firearm, T. M. Thorsen 867,685
Fireproof window, S. H. Pomeroy..... 867,925
Floor surfacing machine, Taft & Verdin.... 867,620
Flooring and making the same, G. H. Bennett 867,637
Fuel and making the same, artificial, Drawbaugh & Gamble 867,915
Furnace, V. W. Blanchard 867,905
Game apparatus, J. B. Fry 867,652
Game apparatus, G. S. Parker 867,935
Garment fastener, F. G. Wright 867,864
Garment hanger, J. F. Williams..... 867,691
Gas burner, incandescent, R. N. Oakman.. 867,590
Gas burners, pneumatic valve controlling apparatus for, R. N. Oakman..... 867,591
Gas burning air heating furnace, V. W. Blanchard 867,906
Gas in mains, means for ascertaining the temperature of illuminating, Bond & Tutwiler 867,907
Gas meter, rotary, T. Thorp.....867,766, 867,854
Gases in pipe conduits, apparatus for obtaining a uniform rate of flow of, T. Thorp 867,855
Glass having surface projections, manufacture of, F. L. O. Wadsworth 867,931
Go-cart, E. C. Moore 867,894
Governor, C. R. Lanphear 867,664
Grain cleaner and separator, W. C. Harmon 867,880
Graphophone sound reproducer, W. Hart... 867,821
Grate, tubular, E. Kyllonen..... 867,582
Grater, H. Van der Voort..... 867,687
Gun layers in pointing guns, apparatus for instructing, R. D. White 867,862
Guns, single trigger mechanism for double barreled, O. W. Brenizer 867,697
Harrow, J. H. Johnson 867,731
Harvesting and husking machine, corn, W. B. Metcalf 867,893
Hat guard, A. Fornander 867,814
Hay carrier, D. M. Motherwell 867,589
Heat transferring apparatus, V. Croizat.... 867,803
Heater. See Water heater.
Heater, W. S. Turney 867,768
Heating device, S. Z. de Ferranti..... 867,576
Heel, boot and shoe, W. F. Bostock..... 867,909
Hinge, G. C. Witt 867,775
Hinge, double acting, J. J. Cowell 867,913
Hook, J. Krimer 867,886
Humidifier, C. E. Whitmore 867,690
Index system, card, W. M. Stretch.867,618, 867,930
Induction coil apparatus, E. C. Wilcox.... 867,627
Inhaler, J. H. McCulloch..... 867,827
Insulator, J. C. Barclay 867,901
Internal combustion engine, C. H. T. Alston 867,777
Ironing table, J. Garret 867,816
Jar cap, E. J. Smith, reissue 12,701
Jars, bottles, and like receptacles, closure for, M. D. Converse 867,705
Journal box, S. Hicks 867,823
Kinetoscope, Spaulding & Smith 867,682
Knitting machine, circular independent needle, H. Stoll, Jr. 867,764
Knob, kettle cover, E. A. Sawyer 867,842
Knobbling furnace, W. F. Westlund 867,861
Lamp shade, W. J. Boesen 867,871
Lard press, E. A. Sproat 867,762
Lathe tool, W. Collins 867,798
Lathe tool and holder, B. A. Hemenway.. 867,725
Lifting jack, G. R. Booth 867,786

© 1907 SCIENTIFIC AMERICAN, INC.



"Star" Foot and Power Screw Cutting Automatic Cross Feed **Lathes**

FOR FINE, ACCURATE WORK

Send for Catalogue B.

SENECA FALLS MFG. CO.
695 Water Street,
Seneca Falls, N. Y., U. S. A.

Engine and Foot Lathes

MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. BEST MATERIALS. BEST WORKMANSHIP. CATALOGUE FREE

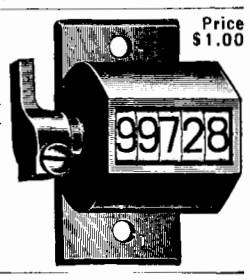
SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses.
SHEPARD LATHE CO., 133 W. 2d St. Cincinnati, O.

Veeder Counters

to register reciprocating movements or revolutions. Cut full size.

Price $1.00



Booklet Free
VEEDER MFG. CO.
18 Sargeant St.
Hartford, Conn.

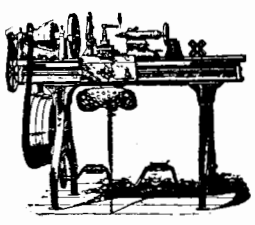
Cyclometers, Odometers, Tachometers, Counters and Fine Castings.

PATENTS

Our Hand Book on Patents, Trade-Marks, etc., sent free. Patents procured through Munn & Co. receive free notice in the

SCIENTIFIC AMERICAN

MUNN & CO., 361 Broadway, N. Y.
BRANCH OFFICE: 625 F St., Washington, D.C.



FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL & REPAIR WORK, ETC.

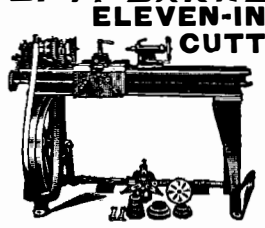
From 9-in. to 13-in. swing. Arranged for Steam or Foot Power, Velocipede or Stand-up Treadle.

Send for Lathe Catalog.

W. F. & JNO. BARNES CO.
Established 1872.
1999 Ruby St., ROCKFORD, ILL.

HOME MADE DYNAMOS. — SCIENTIFIC AMERICAN SUPPLEMENTS **161** and **600** contain excellent articles with full drawings. Price 10 cents each by mail. Munn & Company, 361 Broadway, New York City, and all newsdealers.

B. F. BARNES— ELEVEN-INCH SCREW CUTTING LATHE



For foot or power as wanted. Has power cross feed and compound rest. A strictly high grade, modern tool. Ask us for printed matter. Descriptive circulars upon request.

B. F. BARNES CO.
Rockford, Ill.
European Branch, 149 Queen Victoria St., London, E. C.

Atlantic City

3 HOURS FROM NEW YORK VIA NEW JERSEY CENTRAL

Solid Vestibule Trains, Buffet Parlor and Dining Cars. Leave West 23d St. 9.50 a.m. daily; 12.50 p.m. (Saturdays only); 3.20 p m. daily (except Sundays); 2.20 p.m. (Sundays only)

Leave Liberty St. 10.00 a.m. daily; 1.00 p m. (Saturdays only); 3.40 p m. daily (except Sundays); 2.30 p.m. (Sundays only)

Instructive Scientific Papers

ON TIMELY TOPICS

Price 10 Cents each by mail

ARTIFICIAL STONE. By L. P. Ford. A paper of immense practical value to the architect and builder. SCIENTIFIC AMERICAN SUPPLEMENT **1500.**

THE SHRINKAGE AND WARPING OF TIMBER. By Harold Busbridge. An excellent presentation of modern views; fully illustrated. SCIENTIFIC AMERICAN SUPPLEMENT **1500.**

CONSTRUCTION OF AN INDICATING OR RECORDING TIN PLATE ANEROID BAROMETER. By N. Monroe Hopkins. Fully illustrated. SCIENTIFIC AMERICAN SUPPLEMENT **1500.**

DIRECT-VISION SPECTROSCOPES. By T. H. Blakesley, M.A. An admirably written, instructive and copiously illustrated article. SCIENTIFIC AMERICAN SUPPLEMENT No. **1493.**

HOME MADE DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS **161** and **600** contain excellent articles with full drawings.

PLATING DYNAMOS. SCIENTIFIC AMERICAN SUPPLEMENTS **720** and **793** describe their construction so clearly that any amateur can make them.

DYNAMO AND MOTOR COMBINED. Fully described and illustrated in SCIENTIFIC AMERICAN SUPPLEMENTS **844** and **865.** The machines can be run either as dynamos or motors.

ELECTRICAL MOTORS. Their Construction at Home. SCIENTIFIC AMERICAN SUPPLEMENTS **759, 761, 767, 641.**

Price 10 Cents each, by mail

Order through your newsdealer or from

MUNN & COMPANY
361 Broadway New York

Liquid distributing means, E. J. Moore	867,586
Lock and latch, combined, J. W. Lindsay	867,585
Lock protecting device, F. Duesterwald	867,916
Locomotive cab ventilator, R. Burns	867,701
Loom shuttle, F. A. Mills	867,740
Loom starting and stopping mechanism, G. B. Ambler	867,934
Looms for weaving, warp stop motion for, F. Pick	867,596
Magnetic separator, J. B. McCabe	867,744
Mail crane, D. J. Berthold	867,785
Mailing card, return, G. H. Scragg	867,613
Marking gage, A. Solomon	867,761
Measuring pole, extensible, J. Edwards	867,812
Mechanical motion, H. A. Ballard	867,866
Mechanical movement, W. B. Norton	867,748
Melting furnace, T. D. Bausher	867,781
Milk, etc., apparatus for concentrating, C. H. Campbell	867,641
Mines, etc., system for ventilating, G. M. Capell	867,791
Miter box, W. M. Potter	867,927
Mortise case, F. Egge	867,574
Motor, K. F. Ericksen	867,648
Organ stop action, combination, J. E. Philie	867,751
Oscillation detector, L. De Forest	867,878
Oscillation responsive device, L. De Forest	867,876
Oscillations, detecting, L. De Forest	867,877
Phonographs, friction reproducing attachment for, A. N. Pierman	867,597
Piano, automatic, J. W. Darley, Jr.	867,875
Piano, autopneumatic grand, Sandlas & Darley	867,840
Pig iron, treating, G. S. Page	867,593
Pipe, L. Underwood	867,769
Pipe cleaner, M. E. Kanaly	867,885
Pipe coupling, E. S. Williamson	867,628
Pipe hanger, M. Schang	867,760
Pipe or hose coupling, J. H. Phillips, Jr.	867,752
Pitch substitute and making the same, K. Rucker	867,757
Planter, I. A. Weaver	867,625
Plow, E. J. Ingram	867,883
Plug in switch, H. D. Murdock	867,743
Pneumatic suspension means, J. H. Clark	867,570
Polishing machine, P. H. Barz	867,633
Printing machine, automatic plate, T. R. & J. H. Demery	867,708
Printing press, J. F. Ames	867,778
Printing press, T. A. Needham	867,897
Printing press feed and delivery mechanism, automatic, S. C. Beale	867,634
Printing presses, printed sheet receiving table for, F. W. Thomas	867,684
Propeller, O. Peterson	867,595
Propeller screw, D. W. Taylor	867,853
Pump, S. G. Skinner	867,616
Pump, R. H. Stoker	867,849
Pump and similar apparatus, force, J. Weeks	867,932
Pump valve, direct acting steam, W. Weir	867,774
Puzzle, J. H. Savidge	867,841
Quilling machine stop motion, D. Lawlor	867,824
Rack. See Display rack.	
Rail joint, J. J. Herndon	867,657
Railway switch, electrically operated, F. J. Johns	867,918
Rake and baling press, combined, P. E. Day	867,805
Range, gas, W. A. Mills	867,741
Ratchet wrench, A. E. Smith	867,845
Rope carrier, fall, Delaney & Lambert	867,573
Rotary expansion engine, E. Horn	867,581
Rowlock, B. F. Tripp	867,686
Rubber overshoe, F. C. Hood	867,882
Rubber substitute and making the same, hard, C. Marter	867,737
Rule, H. Jeffreys	867,730
Sash lock, H. Buttress	867,911
Saw filing device, W. M. Potter	867,926
Saw set, W. Carmer	867,792
Sawing machine, H. W. Cotton	867,643
Scale, D. J. Holliger	867,729
Scale, computing, Ozias & Hopkinson	867,671
Scissors or shears, T. S. Sayre	867,607
Screw clamp, J. L. Taylor	867,622
Seal, F. V. Brooks	867,699
Seal, bottle, L. Bartlett	867,902 to 867,904
Sewing implement holder, H. A. Lee	867,583
Shade bracket, W. A. Bennett	867,869
Sharpening machine, saw tooth, J. P. Hedstrom	867,723
Sheaves, preparing stalks of grain for forming, M. Rice	867,601
Shock loader, D. W. Kemp	867,662
Sifter, ash, A. M. Nelson	867,670
Sign, electric, W. A. F. Becker	867,635
Skin treating apparatus, W. R. Smith	867,847
Skins, etc., apparatus for drying, W. R. Smith	867,848
Slack adjuster, A. Parker-Smith	867,672
Slack adjuster, W. H. Sauvage	867,676 to 867,678
Slicing machine, E. A. Seaburg	867,844
Small arm attachment, H. B. Hollifield	867,728
Smoking pipe, P. F. McClure	867,826
Snap fastener, W. C. Stiles	867,929
Sound reproducing instruments, trumpet or horn of, R. Revell	867,836
Spigot, metal coated, H. Auchu	867,780
Splitting machine, C. Eitle	867,711
Spoke tightening device, J. L. Delhomme	867,645
Spraying apparatus, R. Ditchfield	867,806
Stamp e. try, F. B. Miller	867,922
Stackers, attachment to elbows of wind, S. W. Erickson	867,716
Stage illusions, means for producing, H. Goldin	867,879
Steam, apparatus for separating oil and water from, D. B. Morison	867,742
Steam generator, C. Bakehaus	867,631
Steam trap, W. C. Brown	867,700
Steel, alloy, J. Churchward	867,642
Steering wheel muff, W. H. Mandeville	867,736
Stenciling machine, W. G. Fuerth	867,577
Sterilizing closed vessels, L. Nathan	867,831
Stop motion, electric, F. A. Sandford	867,758
Store service apparatus, Davis & Ault	867,804
Stove, J. E. Rockey	867,838
Stove and apparatus for heating air, S. C. Davidson	867,572
Stove and radiator, gas, F. De Grauwe	867,644
Surgical instrument holder, M. P. Hermann	867,727
Suspender end, H. Weiss	867,860
Switch box, H. J. Warthen	867,624
Switch safety device, point, L. Dunn	867,709
Synchronizing means, space electromechanical, A. H. Stewart	867,898
T-pipe, W. H. Bellmaine	867,784
Table. See Ironing table.	
Table rack and exhibitor, M. H. Keating	867,661
Talking machine attachment, Weaver & Carney	867,773
Tank emptying apparatus, liquid, S. W. Miller	867,669
Tape applying machine, I. Dreyfuss	867,807
Tapping mechanism, T. G. Morse	867,923
Telegraph transmitter, J. C. Barclay	867,900
Telephone system, F. E. Mayberry	867,892
Threshing machine feeder, D. McIvor	867,829
Tie rod, L. W. Noyes	867,749
Tile, illuminating, J. B. French	867,650
Tire, automobile, G. G. Sullivan	867,851
Tire covering, Eukers & Atcheson	867,717
Tire, elastic, J. W. Rock	867,756
Tire, vehicle, A. D. Ray	867,600
Toggle bolt, J. H. Cook	867,799
Tool, pneumatic, E. M. Tobin	867,856
Torpedo placer, railway W. C. Beckwith	867,783
Tow, treating fibrous, M. H. Colahan	867,704
Trace holder, W. L. Richardson	867,603
Traction machine, G. W. McGill	867,828
Trap, G. W. Leavenworth	867,920
Trousers, means to press creases in, N. M. Court	867,912
Truck and step ladder, combination, J. E. Randall	867,754
Truck, locomotive, W. Pervenko	867,835
Tubes, manufacture of, W. J. Still	867,763
Turbine, N. Baashuus	867,566
Turbine, M. Haeberlein	867,656
Turbine, steam, R. Schulz	867,611
Twist drill, G. J. Bragg	867,639
Twisting together the filaments of a thread of artificial silk, machine for, M. Waddell	867,623
Type matrices and types, justifying mechanism for, E. V. Beals	867,867
Typewriter, L. R. Roberts	867,674
Typewriter, E. V. Beals	867,868
Typewriting machine, W. E. Mason	867,666
Valve, D. J. Galbraith	867,578
Valve and meter, combination, E. J. Moore	867,587

Cold-Proof

Underwear

Wright's Health Underwear differs from common underwear in that it protects the wearer from catching colds. It is made as no other underwear is, on the wonderful Wright's loop-fleece principle. Upon the foundation fabric is woven a myriad of tiny loops of wool forming a fleecy lining to the garment. This open woven fleece gives the skin the requisite ventilation, allows the pores to breathe, carries off perspiration and allows it to evaporate outside, leaving the skin dry and healthy.

Ordinary catch-cold underwear is tightly woven, non-absorbent, holds the perspiration on the skin—chills the body—gives colds. With its many advantages Wright's Health Underwear costs no more than common underwear. Ask your dealer for it and write for free book "The Loop of Health and the Fleece of Comfort."

WRIGHT'S HEALTH UNDERWEAR CO., 75 Franklin Street, New York.

Cushman

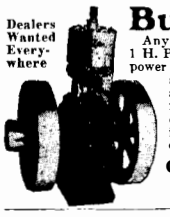
8 H. P. Weight 185 lbs.

The Man Who Gets THE MOTOR

must invest enough money to insure Good Material and Workmanship. Cushman Motors have ground cylinders, pistons, piston rings and crank shafts, crank and piston pins hardened, gas tight adjustable bearings. All parts finished according to micrometer measurements and are interchangeable. Write for catalogue if interested. Engines from 2 to 14 h.p., 2-cycle, light weight, easy starting.

Cushman Motor Co., Lincoln, Neb.

Dealers Wanted Everywhere



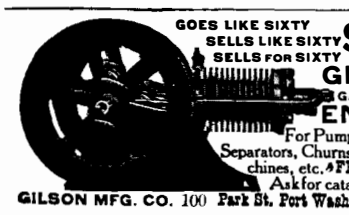
Build It Yourself

Any boy or amateur can build this perfect little 1 H. P. vertical, 2 cycle gasoline engine on a foot power lathe from rough castings by following our simple blue print working drawings. Others are doing it, so can you. No engine equals it for simplicity, strength and durability. Fills every requirement where light motive power is needed. Write for booklet and prices on castings and finished engines.

GARDNER MOTOR COMPANY
5011 Delmar Ave., St. Louis, U. S. A.

RADIUM AND THE RADIO-ACTIVE Substances. No better or clearer scientific account has been published than that contained in SCIENTIFIC AMERICAN SUPPLEMENT **1429.** The paper presents all that is at present known about radium and the radio-active substances. Price 10 cents, by mail. Munn & Co., 361 Broadway, New York City and all newsdealers.

RUBBER STAMP MAKING.—THIS article describes a simple method of making rubber stamps with inexpensive apparatus. A thoroughly practical article written by an amateur who has had experience in rubber stamp making. One illustration. Contained in SUPPLEMENT **1110.** Price 10 cents. For sale by Munn & Co. and all newsdealers.



GOES LIKE SIXTY
SELLS LIKE SIXTY
SELLS FOR SIXTY
$60
GILSON
GASOLENE
ENGINE
For Pumping, Cream Separators, Churns, Wash Machines, etc. FREE TRIAL
Ask for catalog—all sizes

GILSON MFG. CO. 100 Park St. Port Washington, Wis.

Pipe Cutting and Threading Machine

For Either Hand or Power

This machine is the regular hand machine supplied with a power base, pinion, countershaft, etc., and can be worked as an ordinary power machine or taken from its base for use as a hand machine. Pipe ⅛ in. to 15 in. diameter handled easily in small room. Illustrated catalogue—price list free on application.

THE CURTIS & CURTIS CO.
6 Garden St., Bridgeport, Conn. Branch Office, 60 Centre St., N. Y.

Your Advertising

INSERTED IN THE

Scientific American

would mean its being seen and read by the leading minds in

EVERY BRANCH OF INDUSTRIAL PROGRESS

The SCIENTIFIC AMERICAN reaches a thinking class of people who buy freely.

They are amply able to purchase any product advertised attractively.

There is no other publication having the same advertising value for your purpose, because it combines the best elements of the technical papers in your particular line with the large result-giving circulation of a general advertising medium.

In one year it carried successfully the advertisements of 298 different lines of goods, from paper clips at 10 cents to ice machinery at $15,000.

We have a department of experts to co-operate with prospective advertisers.

Will you let us take up your advertising and show you Why?

MUNN & CO., - 361 Broadway, New York

© 1907 SCIENTIFIC AMERICAN, INC.

Classified Advertisements

Advertising in this column is 50 cents a line. No less than four nor more than ten lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

BUSINESS OPPORTUNITIES.

FOR SALE.—Strictly modern gray iron foundry completely equipped and in daily operation on profitable machinery work. Located in Michigan town with excellent shipping facilities. Best of reasons for selling, and will make liberal terms. Full information cheerfully furnished. Profitable, Box 773, New York.

WILL MARKET SUITABLE SPECIALTY to retail up to $30.00; also small novelty. For further particulars and full information address W. C. J., Box 773, New York.

TO FINANCIERS.—Wanted a man with $1,000 to finance a newly patented parlor game, to place on the market for Christmas. This is a first-class proposition to investors. For further particulars and full information address Castonquay & Staples, Box 381, Stamford, Conn.

WANTED.—Patented article of merit to manufacture and market. Have abundant capital and excellent organization. Full description necessary to secure attention. Address W. J. W., Box 1,828, New York.

ROYALTY SALESMAN WANTED to travel and place manufacture and sale on royalty of splendid household article. Right man can clear $10,000 in a few months. Address XX, Box 773, New York.

START a mail order business; we furnish everything necessary; only few dollars required; new plan, success certain; costs nothing to investigate. Milburn-Hicks, 813 Pontiac Bldg., 358 Dearborn St., Chicago.

INVENTORS AND MANUFACTURERS, having new, useful, unintroduced articles (no toys), investigate. With an efficient corps of canvassers, we operate in Idaho, Washington and Oregon. Goods bought outright. Correspondence solicited. Novelty Distributing Co., 114 Second St., Walla Walla, Wash.

INVENTORS.—Send for free sample copy "World's Progress," devoted to interests of inventors. All latest developments in scientific and industrial world. World's Progress, 510 12th St., Washington, D. C.

INVENTORS, MANUFACTURERS! — Special machines designed, built, repaired, and experimental work executed in a well-equipped machine shop. J. G. C. Mantie, Mechanical Engineer, 1907 Park Ave., New York.

PATENTED ARTICLES in wire, brass and other metals made to order. Stamping, press work. Prices reasonable. Special low prices to established trade. The Fischer Mfg. Co., Paterson, N. J.

PATENTS FOR SALE.

COMBINATION Folding Parallel Bars, Turning Pole, Hammock Rack and Children's Swing For Sale for cash or on royalty. Patented in July. Useful in schools and homes. Address Geo. C. Berglund, Cloquet, Minn.

FOR SALE.—Patents Nos. 837,774 and 857,441. Wheel Flange Oiler and Trunk Rope Fastener. Both money makers if handled by right party. For particulars write E. W. Carroll, Sasso, Arizona.

FOR SALE.—U. S. Patent No. 839,627 (Automatic Door Opener and Closer), invented by a Japanese called K. Nishimoto of California. The latest and best invention of this kind. Address K. N., Box 773, New York.

AGENTS WANTED.

AGENTS WANTED. — Big profits; Gre-Solvent cleans hands instantly; removes grease, paint, ink, etc.; every mechanic buys; get sample and terms. Utility Co., 646 West 44th Street, New York.

EXCLUSIVE AGENCIES GIVEN.—We want a good man in every town to sell first-class electrical specialties during spare hours to houses, stores and especially factories. Easy sellers and good big profit. Write for our Sole Agency. Hill-Wright Electric Company, 105 Reade Street, New York City.

TYPEWRITERS.

THE PUBLIC is at last awakening to the fact that a standard high-grade typewriter can be sold for $50. Exclusive territory now open to a limited number of first-class men who can take charge and push things. Money-returns splendid. An exceptional proposition, the chance of a lifetime will be made to those who suit us. Address The American Typewriter Co., 261 B'way, N.Y.

CLEARANCE SALE—Remingtons Densmores, Blickensderfers, Williams, $12.50; Postals, Hammonds, $10; Underwoods, Olivers, $35. Orders filled or money back. Standard Typewriter Ex., Suite 66, 23 Park Row, N. Y.

MOTION PICTURES.

THE MOVING PICTURE WORLD, weekly, 10 cents per copy; yearly subscription $2. The only paper devoted to the moving picture, illustrated song and lantern lecture field. Moving Picture World, Box 450, N.Y.

WANTED.—Addresses of enterprising men contemplating entering the moving picture business. Biggest paying proposition for small capital known. Write for information. The Actograph Co., 50 Union Square, N.Y.

MODELS & EXPERIMENTAL WORK.

INVENTIONS PERFECTED.—Mechanical Drawings, Tools, Dies, Special Automatic Machinery and Novelties manufactured. The Victor Model and Novelty Co., Phone 3359 Worth, Corner Pearl and Centre Sts. N. Y.

AUTOS.

ON ACCOUNT OF THE NUMEROUS INQUIRIES we have recently received for chauffeurs, we have decided to open a department that will enable you to become an experienced automobile driver and mechanic. Special course for those out of town. Write Automobile Exchange, 1416 Broadway, New York City.

BOOKS AND MAGAZINES.

ELECTRICIAN AND MECHANIC.—Practical monthly magazine for electrical and mechanical students and workers. Publishes illustrated directions for constructing dynamos, motors, gasoline engines, wireless telegraphy, electroplating, electrical wiring, mechanical drawing, using tools, furniture construction, boat building, all kinds of mechanical work. One dollar yearly; trial subscription for three months, twenty cents. List of electrical and mechanical books free. S. A. Sampson Pub. Co., 6 Beacon St., Boston, Mass.

CORRESPONDENCE SCHOOLS.

PATENT LAW AND OFFICE PRACTICE BY MAIL. Free booklet and specimen pages of thoroughly practical course. Price reasonable. Correspondence School of Patent Law, Dept. A, 1853 Mintwood, Wash., D. C.

SCHOOLS AND COLLEGES.

PRACTICAL INSTRUCTION in the engineering use of Algebra, Geometry, Logarithms, Trigonometry, Slide-rule, Planimeter, Perspective and Scales. All by mail. Geert Blaauw, 25 Broad St., 20th floor, Room 12, N.Y. City.

PHOTOGRAPHY.

AMERICAN PHOTOGRAPHY succeeds American Amateur Photographer, Camera and Dark Room and Photo Beacon. The editors of each now join in making a magazine which should be in the hands of every photographer, professional or amateur. 15 cents monthly, $1.50 per year. Three specimen copies for a quarter. Am. Photographic Pub. Co., 361 Broadway, New York.

STEAM ENGINE FOR SALE.

250 H. P. Greene Automatic Cut-off, Double Crank, Non-condensing, Horizontal Engine, size 16 x 42 inches, two cylinders, with band flywheel 14 feet by 31 inches. Speed 75 R. P. M. Built by F. C. & A. E. Rowland, New Haven, Conn. This engine is in excellent condition and has been in regular service in our factory for several years, being displaced by electric equipment in the enlargement of our plant. It may be seen running until October 5, its use being discontinued after that date. Winchester Repeating Arms Co., New Haven, Conn.

AUTOMATIC MACHINERY.

MANUFACTURING.—Special dies, tools, jigs, etc. Inventions perfected, fine model making and experimental work, designing and draughting. Hull Bros., 54 Hudson St., Jersey City. Phone 1099L, J. C.

ELECTRICAL.

ELECTRIC WATER HEATER complete with wire and plug for 110-volt alternating current. Boils 1 pint of water in 1 minute. $1.25 by mail. Richard Toennes, Box 344, Boonville, Mo.

TALKING MACHINE NEEDLES.

I SEND FREE, samples of patented improved Petmecky Multi-tone Needles to all interested in talking machines. Each needle plays 10 records. Millions sold weekly. Petmecky, 348 Broadway, New York.

SEASICKNESS.

SEASICKNESS and Car Nausea prevented, Brush's Remedy (Elixir prophylactic). Guaranteed perfectly Harmless. The only preparation that has never failed. Free booklet proving these statements sent by Brush Chemical Co. 299 Broadway, N. Y. All druggists $1 per bottle.

DEAFNESS.

TO THOSE HARD OF HEARING.—An efficient aid sent for trial, no expense, no risk, no contract, no money unless device be kept. For full particulars address A. O. Tiemann & Company, 107 Park Row, New York.

MISCELLANEOUS.

OUR VACUUM CAP when used a few minutes each day draws the blood to the scalp, causing free and normal circulation, which stimulates the hair to a new, healthy growth. Sent on trial under guarantee. Write for free particulars The Modern Vacuum Cap Co., 617 Barclay Block, Denver, Col.

Valve controller for hydrocarbon engines, fuel, W. F. Rothe 867,605
Valve, faucet, L. M. Hooper 867,580
Valve, flush, G. B. Gaylord 867,653
Valve for compressors and the like, self-acting, F. Strand 867,619
Valve for explosive engines, J. S. Elverson. 867,713
Valve for gas compressors, discharge, A. F. Clarke 867,702
Valve for internal combustion engines, piston, H. W. Adams 867,933
Vault, burial, A. Erlitz 867,813
Vehicle steering mechanism, automatic, W. H. Strickler 867,765
Venting tool, A. C. Pearce 867,673
Vessel hull, S. Golden 867,654
Wardrobe rack, collapsible, F. J. Bast 867,567
Washboard, G. C. Haysler 867,722
Washing machine, J. F. Wade 867,770
Watch barrel, T. S. Bindschedler 867,870
Watch guard, H. N. Bolton 867,694
Water heater, electric, M. W. Willson 867,863
Water motor, C. M. Girton 867,817
Weighing machine, automatic, J. H. McLeod 867,745
Welding copper, W. A. Barnes 867,632
Well packer, W. W. Lewin 867,735
Wheel. See Fan and pump wheel.
Wheel, R. C. Seaton 867,614
Wheel, W. Eichers 867,710
Wheel clamp or anchor, M. Paulson 867,594
Wheel rim and tire construction, vehicle, M. P. Morrison 867,588
Wind instruments, reed protector for, E. Nelson 867,832
Wire holder, N. L. Wine 867,629
Wireless transmission of sonorous vibrations. F. J. McCarty 867,895, 867,896

DESIGNS.

Badge, P. A. Mandabach 38,844
Bag, hand, L. Hauser 38,853
Comb, J. Wilcox ..... 38,847 to 38,852
Knitted fabric, J. J. Curry 38,856
Reflector, electric light, A. D. Curtis 38,854
Spoons, forks, or similar articles, handle for, G. L. Crowell, Jr. 38,845
Spoons, forks, or similar articles, handle for, J. E. Straker, Jr. 38,846
Type, font of, C. W. Smith 38,855

TRADE MARKS.

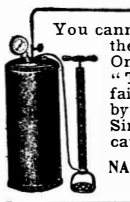
Ale, ginger, Forester Grocery Co. 65,608
Antiseptics, barbers', R. W. Browne 65,471
Batteries, electric, Ampere Manufacturing Co. 65,605
Beer, Joseph Junk Brewing Co. 65,561
Boots and shoes, leather, J. L. Walker & Co. 65,516
Boots, shoes, and slippers, leather, Powell Brothers Shoe Co. 65,509
Bread, H. Matthaei 65,536
Bread and biscuits, Callard, Stewart and Watt 65,502
Brushes and brooms, certain, Lord & Taylor 65,566
Buggies, wagons, and carriages, Hercules Buggy Co. 65,610
Candy, P. Wunderle 65,518
Canned fruits and vegetables, Wayne County Canning Co. 65,541
Cheese, W. J. Eldridge 65,524, 65,525
Chocolates and candy, Wallace & Co. 65,578, 65,579
Cigars, cheroots, and little cigars, V. M. Antuono 65,547, 65,548
Cleaning fluid, Davis Chemical Co. 65,551
Cleaning machinery and parts thereof, air, American Air Cleaning Co. 65,604
Clothing, certain workmen's, J. H. Rice & Friedmann Co. 65,527
Coats, vests, trousers, and overcoats, Kentucky Jeans Clothing Co. 65,562
Coffee, Baker & Co. 65,520
Color setting compound, A. Elhardt Sohne .. 65,473
Colors, dry and in oil, Siemon & Elting 65,600
Comb polish, Collonoid Co. 65,584
Cotton piece goods and blankets, Jackson Co. 65,595
Cotton piece goods, bleached and unbleached, E. J. Fraser-Campbell, 65,588 to 65,590
Cotton piece goods, woven, Hill Manufacturing Co. 65,592, 65,593
Cream of tartar, bicarbonate of soda, and saleratus, John Bird Co. 65,494
Dental tooth paste, Goodrich & Siqveland .. 65,553
Detergent, fluid, Zozoene Manufacturing Co. 65,580
Disinfectants, T. W. Browne 65,472
Fence, wire, Farmers' Fence Co. 65,474
Flavoring extracts, Grand Union Tea Co. ... 65,503
Flour, wheat, Sheffield-King Milling Co. 65,512
Flour, wheat, Climax Milling Co. 65,522
Flour, wheat, Western Star Mill Co. 65,543
Flour, winter wheat, Hall & Woods Co. 65,526
Furniture polish, Orchard & Wilhelm Carpet Co. 65,598
Gloves, leather, Saranac Glove Company ... 65,572
Hats and caps, certain, Parham-Matthews Hat Co. 65,539
Hats, felt, Maxim Hat Works 65,507
Headwear, certain, Lamson & Hubbard, 65,530 to 65,533 65,563
Hoists, Chisholm & Moore Manufacturing Co. 65,607
Insulating material, electric, Electric Service Supplies Co. 65,580
Knitted goods, certain, Novelty Knitting Co. 65,567

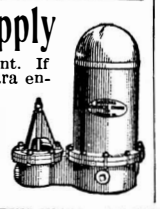
SORE THROAT
To prove the Efficiency of
Hydrozone
to Sore Throat Sufferers, I will send **One 25 Cent Bottle Free** to anyone **mentioning this paper** and sending 10 cents to pay postage and packing. Hydrozone is a harmless germicide, indorsed and successfully used by leading physicians. Not genuine without my signature on label. Ask for Booklet on Treatment of Diseases. Sold by Leading Druggists.
Charles Marchand
Chemist and Graduate of the "Ecole Centrale des Artes et Manufactures de Paris" (France)
Dept. U, 63 Prince Street, New York

BLAKE TUBE FLUX For SOLDERING

Full Size of Tube 1" x 5"
Patent Applied for
Note Aluminum Tip
Sample tube postpaid 20c.
BLAKE SIGNAL & MFG. CO., 246 Summer St., Boston, Mass.

ROTARY PUMPS AND ENGINES
Their Origin and Development.—An important series of papers giving a historical resume of the rotary pump and engine from 1588 and illustrated with clear drawings showing the construction of various forms of pumps and engines. 38 illustrations. Contained in SUPPLEMENTS 1109, 1110, 1111. Price 10 cents each. For sale by Munn & Co. and all newsdealers.


You cannot fail to make money with the assistance of our complete One Light System, in case $10. "THE LIGHT that NEVER fails." U. S. Systems approved by the Board of Underwriters. Simple, safe and durable. Write for catalogue illustrating our full line.
NATIONAL STAMPING AND ELECTRIC WORKS
150-158 S. Jefferson St., Chicago, U. S. A.

Automatic Water Supply
Most economical, reliable and efficient. If you have running water the Niagara engines will elevate 35 feet for each foot of fall obtainable from spring, brook, or river, delivered to any distance. Write for catalogue.

Niagara Hydraulic Engine Co.
140 Nassau Street, N. Y.

GENTLEMEN
WHO DRESS FOR STYLE NEATNESS, AND COMFORT WEAR THE IMPROVED
BOSTON GARTER
THE RECOGNIZED STANDARD
The Name is stamped on every loop —
The Velvet Grip
CUSHION BUTTON CLASP
LIES FLAT TO THE LEG—NEVER SLIPS, TEARS NOR UNFASTENS
Sample pair, Silk 50c., Cotton 25c. Mailed on receipt of price.
GEO. FROST CO., Makers
Boston, Mass., U. S. A.
ALWAYS EASY

WIRELESS TELEGRAPHY.—ITS PROgress and Present Condition are well discussed in SCIENTIFIC AMERICAN SUPPLEMENTS 1425, 1426, 1427, 1386, 1388, 1389, 1383, 1381, 1327, 1328, 1329, 1431. Price 10 cents each, by mail. Munn & Co., 361 Broadway, New York City, and all newsdealers.

New Auto Bargain
A few, new, 4 cylinder cars, regular price, $2,250. While they last, $1,250. Makers will not permit advertising name. We guarantee standard car, made by one of the best known manufacturers. Guaranteed; free of parts.
We Buy, Sell and Exchange. Largest dealers and brokers in New and Second-hand Autos in the world. Also supplies at cut prices. Send for complete bargain sheet No. 129.
TIMES SQUARE AUTOMOBILE CO.
1599-1601 Broadway, New York, above 48th St.

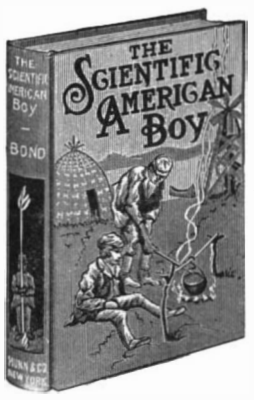
1908 MODEL

VICTOR HAND-FORGED
Water cooled engine; wheels 37 inches; 1 1-4 inch solid rubber tires; speed from 1 to 25 miles per hour. No country too rough for the **Hand-Forged Victor**
Price $450.00, including leather top, fenders, lamps, horn, tools, etc. Dos a Dos seat $40 extra. Write for full particulars.
Victor Automobile Mfg. Co. 113 Carroll St., St. Louis, Mo.

FREE to
Scientific American Subscribers

Home Mechanics for Amateurs
By GEORGE M. HOPKINS
Author of "Experimental Science"
12mo, 370 Pages. 320 Illustrations. Price, $1.50 postpaid
The book deals with wood-working, household ornaments, metal-working, lathe work, metal spinning, silver working; making model engines, boilers and water motors; making telescopes, microscopes and meteorological instruments, electrical chimes, cabinets, bells, night lights, dynamos and motors, electric light, and an electrical furnace. It is a thoroughly practical book by the most noted amateur experimenter in America.
Every reader of "Experimental Science" should possess a copy of this most helpful book. It appeals to the boy as well as the more mature amateur.

Scientific American Reference Book
12mo, 516 Pages, Illustrated, 6 Colored Plates
Price, $1.50 Postpaid
The result of the queries of three generations of readers and correspondents is crystallized in this book, which is indispensable to every family and business man. It is extensively used by government officials. The book contains 50,000 facts and is much more complete and exhaustive than has ever been attempted. It is profusely illustrated with engravings and comparative diagrams. It tells how to harness a horse and read a gas meter as well as giving hundreds of statistical tables. The very wide range of topics treated may be judged by the table of contents which is mailed free on request.



The Scientific American Boy
By A. RUSSELL BOND
12mo. 320 Pages. 340 Illustrations. Price, $2.00 Postpaid
This is a story of outdoor boy life, suggesting a large number of diversions which, aside from affording entertainment, will stimulate in boys the creative spirit. In each instance complete practical instructions are given for building the various articles.
The needs of the boy camper are supplied by the directions for making tramping outfits, sleeping bags and tents; also such other shelters as tree houses, straw huts, log cabins and caves.
The winter diversions include instructions for making six kinds of skate sails and eight kinds of snow shoes and skis, besides ice boats, scooters, sledges, toboggans and a peculiar Swedish contrivance called a "rennwolf."
Among the more instructive subjects covered are surveying, wigwagging heliographing and bridge building, in which six different kinds of bridges, including a simple cantilever bridge, are described.
In addition to these, the book contains a larger number of miscellaneous devices, such as scows, canoes, land yachts, windmills, water wheels and the like. A complete table of contents sent on request.

TO OUR SUBSCRIBERS **If your name is at present upon our list as a subscriber for SCIENTIFIC AMERICAN write to us and we will let you know our plan whereby you may obtain all the above books absolutely *FREE***
MUNN & COMPANY, 361 Broadway, New York City

© 1907 SCIENTIFIC AMERICAN, INC.

Manufacturers!

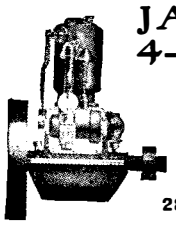
Investigate

Portsmouth, Virginia

Portsmouth offers unequalled advantages for the profitable operation of almost any manufacturing industry. It is the natural gateway between the resources and markets of the North and South, drawing from and catering alike to both. Cheap fuel at the very door, an abundance of reliable labor and an inexhaustible supply of raw material. Nine lines of railway and a score of lines of water transportation assure exceptionally low freight rates. A delightfully even climate, pure water, good schools, good health and beautiful homes.

Splendid factory sites and business opportunities are now available. Valuable assistance will be given investigators. Full particulars on request. Address

I. T. VAN PATTEN, SECRETARY, PORTSMOUTH, VIRGINIA.



JAGER Marine 4-Cycle Engines

Skillfully designed and well built. Single lever control, combining automatic carburettor with spark advance. Develops wide speed range and reliability under most trying conditions Sizes 3 to 60 h. p. Send for catalog.

CHAS. J. JAGER CO.
281 Franklin, cor. Batterymarch St. Boston, Mass.

How to Construct An Independent Interrupter

In SCIENTIFIC AMERICAN SUPPLEMENT, **1615**, A. Frederick Collins describes fully and clearly with the help of good drawings how an independent multiple interrupter may be constructed for a large induction coil.

This article should be read in connection with Mr. Collins' article in SCIENTIFIC AMERICAN SUPPLEMENT, **1605**, **"How to Construct a 100-Mile Wireless Telegraph Outfit."**

Each Supplement costs 10 cents; 20 cents for the two. Order from your newsdealer or from

MUNN & CO., 361 Broadway, New York

WET PROCESS CONCRETE IS BEST

Our new Invincible Concrete Block Machine makes blocks face down, wet process, damp cured. Triple Tier Racking System cures and bleaches to perfection. Tandem. Invincible makes two blocks at once. New catalog free. **The Pettyjohn Co.,** 615 N. 6th St., Terre Haute, Ind.

DRYING MACHINES

For all kinds of granular materials. S. E. Worrell, Hannibal, Mo.

DIE WORK | SPECIAL TOOLS | MODELS NOVELTIES
Experimental Work for Inventors
H. TURNER TOOL CO., 215 S. Clinton St., Chicago

MASON'S NEW PAT. WHIP HOIST

for Outrigger hoists. Faster than Elevators, and hoist direct from teams. Saves handling at less expense.

Manfd. by VOLNEY W. MASON & CO., Inc. Providence, R. I., U. S. A.

ELECTRICAL APPARATUS REPRE sented by Conventional Diagrams in Drawings.—Fifty diagrams showing the usual method of illustrating electrical apparatus in drawings. A labor saving paper. Contained in SUPPLEMENT **1106**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

LEARN WATCHMAKING

We teach it thoroughly in as many months as it formerly took years. Does away with tedious apprenticeship. Money earned while studying. Positions secured. Easy terms. Send for catalog.

ST. LOUIS WATCHMAKING SCHOOL, St. Louis, Mo.

VENTRILOQUISM

Learned by any Man or Boy at home. Small cost. Send to-day 2-cent stamp for particulars and proof.
O. A. Smith, Room 481, **2040 Knoxville Ave., Peoria, Ill.**

BUSINESS OPPORTUNITY

Men of business interested in a new field for making money will find in our proposition what they are seeking. We have a **New Plan** in the Mail Order Line that will please those seeking a good investment with large profits. A **Fortune** for the right person. **The F. H. Alden Co., 178 East 4th Street, Cincinnati, Ohio.**

15 CENTS for trial 13 weeks. In this illustrated national weekly all the important news of the world is stated clearly, fairly, and briefly, for busy readers. Many special features of great interest. It is sincere, reliable, entertaining—THE paper for the home. $1 year, takes place of $2 to $4 papers. Try it, 13 weeks for 15 cents.

The Pathfinder $1 A YEAR EVERY WEEK THE NATIONAL NEWS REVIEW.

PATHFINDER, Washington, D. C.

BE A MOTORMAN

Motormen and Conductors Earn Good Wages the Year Around. Electric Railway Course by mail makes you a successful Motorman or Conductor. Work is pleasant. Hundreds of positions open. Other courses listed in our catalog. Write for it today, giving age and weight.

The Wenthe Railway Corres. School, Box 587, Freeport, Ill.

60 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. HANDBOOK on Patents sent free. Oldest agency for securing patents.

Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.

Lacquer or varnish, Sherwin-Williams Co.	65,599
Macaroni and vermicelli, Liberty Maccheroni Mfg. Co.	65,534
Machinery, certain, G. S. Harwood & Son.	65,609
Machinery, certain parts of, Jno. Hy. Andrew & Co.	65,611
Mattresses, felt, Jones Dry Goods Co.	65,529
Medicinal tonic for anemic conditions, Herff & Wilding	65,557
Medicine, blood, T. Mori	65,615
Medicine, certain, Hatton Chemical Co.	65,556
Medicine, certain, C. Borchert	65,549
Medicines, certain, Davis-Bridaham Drug Co.	65,550
Medicines, certain, C. W. Horn	65,558
Medicines, certain, W. F. Severa Co.	65,577
Metal goods, certain, John A. Roebling's Sons Co. 65,491,	65,492
Metal polish, L. Adrot	65,519
Metals, antifriction, Kool Metal Manufacturing Co.	65,495
Mowers and grass catchers therefor, lawn, W. Bingham Co.	65,616
Mushrooms, cepas, jellies, etc., Von Bremen, MacMonnies & Co.	65,514
Oils, varnishes, and japans, paint, Worden Meeker Co.	65,602
Ovens, portable bake, Middleby Oven Manufacturing Co.	65,597
Overalls, coats, and pants, Pandora Overall Co.	65,568
Packing, certain machinery, B. F. Goodrich, 65,469,	65,470
Paints and painters' materials, certain, Andrew Hanley Co.	65,581
Paper, certain, James R. Crompton & Brothers	65,489
Paper, certain, Mittineague Paper Co.	65,496
Paper, tracing, E. G. Soltmann	65,500
Paper, writing, J. W. Butler Paper Co. 65,479 to	65,488
Perfumery, Societe Guerlain	65,576
Perfumery and face tints, Societe Guerlain.	65,575
Perfumes, toilet waters, etc., F. Loeser & Co.	65,565
Photographic dry plates and films, M. A. Seed Dry Plate Co.	65,506
Powders, toilet waters, and perfumes, toilet, Hana Zono Co.	65,555
Pulp board, Indestructible Fibre Co. 65,477,	65,478
Rain coats, coats, waists, and skirts, I. A. Harris & Bro.	65,559
Razors, knives, scissors, and shears, M. Klaas	65,612
Refrigerators, Baldwin Refrigerator Co.	65,521
Remedy for catarrh, hay fever, etc., Hakka Chemical Co.	65,554
Remedy for dyspepsia, etc., Hugo Litz Co.	65,564
Remedy for headaches, T. Mori	65,614
Remedy for rheumatism, L. Thanos	65,513
Remedy, veterinary, Sanderson & Co.	65,571
Roofing and building materials certain, Weatherproof Manufacturing Co.	65,542
Rubber packing, gaskets, and hose, Pennsylvania Rubber Co.	65,499
Salve, gail, F. B. Dennie	65,523
Salves, ointments, and unguents, J. W. Cole & Co.	65,583
Scales, weighing, W. Bingham Co.	65,515
Scales, weighing, E. & T. Fairbanks & Co.	65,552
Sheetings and drillings, Exposition Cotton Mills	65,587
Silk piece goods, Cheney Brothers	65,582
Silver tableware, sterling, Jos. Mayer & Bros.	65,560
Soap, M. Werke Co.	65,535
Soles, wool, D. I. Rogow 65,511,	65,613
Sound recording or reproducing machines, parts thereof, and records therefor, Universal Talking Machine Manufacturing Co.	65,540
Sprays, flexible metallic, Flexo Spray Co.	65,475
Stamps, trading, interchangeable Rebate System Co.	65,504
Starch, laundry, Grand Union Tea Co.	65,476
Steel, Jno. Hy. Andrew & Co.	65,490
Stoves, fireless cook, Republic Metalware Co.	65,569
Stoves, ranges, and heaters, Hoosier Stove Co.	65,594
Tablets, breath, Schandein & Lind. 65,573,	65,574
Tea, Menown & Gregory	65,537
Teas and coffees, McGee Mercantile Co.	65,508
Teeth, amalgam for filling, J. B. Z. Roberts	65,570
Tobacco, chewing and smoking, American Tobacco Co. 65,544 to	65,546
Tobacco, smoking and chewing, Warfield, Pratt Howell Co.	65,517
Tools, certain hand, Abner Doble Co.	65,603
Traps, animal, Oneida Community, 65,497, 65,498,	65,538
Valves, Ashton Valve Co.	65,468
Watches, watch parts and cases, A. Wittnauer Co.	65,501
Waterproofing compound, certain, T. F. Koch	65,505
Whiskies, rye and bourbon, W. C. Fulcher.	65,591
Whisky, P. Donoghue	65,585
Whisky, L. Sonnenschein	65,601
Whisky, brandy, rum, and gin, M. Wollstein & Co.	65,596
Windmills, Baker Manufacturing Co.	65,606
Wire, certain, John A. Roebling's Sons Co., 65,493,	65,528

LABELS.

"Alonso Rejas," for cigars, Alonso Rejas Ca.	13,820
"Common Sense Cathartic Gum," for chewing gum, Common Sense Gum Co.	13,824
"Common Sense Cough Gum," for chewing gum, Common Sense Gum Co.	13,826
"Jewel Cement," for a cement, E. B. Channell	13,829
"La Sano," for cigars, Schmidt & Co.	13,818
"Listerated Pepsin Gum," for chewing gum, Common Sense Gum Co.	13,825
"Muscle Culture Gum," for chewing gum, Common Sense Gum Co.	13,827
"Quick Death," for a disinfectant and Insecticide, World Disinfecting & Insecticide Co.	13,828
"Sp[illegible]," for stogies and cigars, J. G. Scanga	13,819
"So[illegible] Butter-Maker," for butter, G. W. Martin & Bro.	13,822
"Tickle-Chicle Chewing Gum," for chewing gum, A. A. Austin	13,823

PRINTS.

"Alaskan Scene," for a breakfast food, Cream of Wheat Co.	2,127
"B. F. Babbitt's 'Best Soap' and '1776' Soap Powder," for soap and powder, American Lithographic Co.	2,132
"Cream of Wheat Blocks," for a breakfast food, Cream of Wheat Co.	2,129
"Keep Your Eye on Continentals," for tires for automobiles, A. W. Erickson Advertising Agency	2,134
"Men's and Boys' Apparel," for men's and boys' apparel, H. C. Lytton	2,133
"Mother and Child," for a breakfast food, Cream of Wheat Co.	2,130
"Rural Delivery," for a breakfast food, Cream of Wheat Co.	2,128
"The Chef and The Turkeys," for a breakfast food, Cream of Wheat Co.	2,131

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address **Munn & Co., 361 Broadway, New York.**

Easy To Lay Amatite ROOFING

ON TOP OF EVERYTHING

That is just where Amatite roofing should be—on top of all your buildings, keeping them free from leaks year after year.

For all-around service and durability, it is unapproached by any other. It is built of materials that have been tried and tested under every possible weather condition; — each part is tested—the whole is tested before it goes to you.

Is that done with shingles, tin or ordinary ready roofings? How many bad shingles do you find in a bundle? How often do you have to paint or coat the *smooth ready roofings* to keep them tight?

Think about these things—and when you need a new roof, you'll buy Amatite—the roofing with a *real* mineral surface, which does away with painting and repairs.

When you once cover your buildings with Amatite, you have no further trouble or expense.

Any one can lay it—no skilled labor required.

FREE SAMPLE

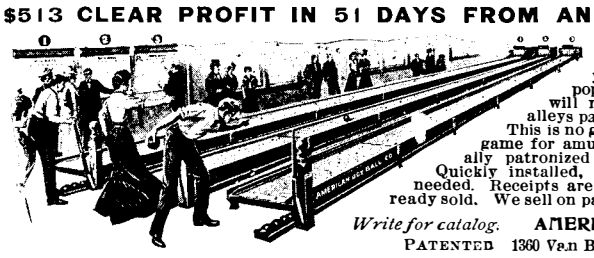
Let us send you a Free Sample and you'll see at once how much *better* it is than the ordinary roofing. A postal card will bring it.

Address nearest office.

BARRETT MANUFACTURING CO.

New York, Chicago, Philadelphia, St. Louis, Cleveland, Allegheny, Cincinnati, Kansas City, Minneapolis, New Orleans, Boston, London, Eng.

$513 CLEAR PROFIT IN 51 DAYS FROM AN INVESTMENT OF $150



Is the result from the operation of one American Box Ball Alley in Sullivan, Ind. Why not go into this business yourself? It is the most practical and popular bowling game in existence. It will make big money in any town. These alleys pay from $25.00 to $65.00 each, per week. This is no gambling device, but a splendid bowling game for amusement and physical exercise. Liberally patronized by the best people of both sexes. Quickly installed, conveniently portable. No pin boy needed. Receipts are nearly all profit. More than 3,000 already sold. We sell on payments and our catalog is free.

Write for catalog. **AMERICAN BOX BALL COMPANY**
PATENTED 1360 Van Buren St., Indianapolis, Ind.

LET US BE YOUR FACTORY

We estimate on anything you want made to order.
STAMPINGS, MODELS, EXPERT WORK
We publish "The Silent Partner," a brainy little magazine, full of good thoughts. Sample free. Write us.
THE GLOBE MACHINE AND STAMPING CO.
970 Hamilton St., Cleveland, O.

ICE MACHINES Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton St., Milwaukee, Wis.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. BAILLARD, 24 Frankfort Street, New York.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO., 228-229 South Street, New York

MODELS CHICAGO MODEL WORKS ESTABLISHED 1867 179 E. MADISON ST. CHICAGO, ILL. WRITE FOR CATALOGUE OF MODEL SUPPLIES

MR. INVENTOR

Send us your models or drawings for our lowest prices
We can develop, perfect or manufacture your invention
MONARCH TOOL CO., 128 Opera Place, Cincinnati, O.

Experimental & Model Work

Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N.Y

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES. SPECIAL MACHINERY.
KONIGSLOW STAMPING & TOOL WORKS. CLEVELAND, O.

Machinery, Dies, Tools, Models, Metal Patterns, Specialties. **Thirty Years' Experience.** A bargain in tin can and other dies, round or square.
AUTO MACHINE WORKS CO.,
214 South Clinton Street, Chicago.

KUHLMAN TRANSFORMERS
Quality always. Single and 3-phase. Prompt delivery.
KUHLMAN ELECTRIC CO. · ELKHART, IND.

INVENTORS We manufacture METAL SPECIALTIES of all kinds, to order; largest equipment; lowest prices. Send perfect sample for low estimate and best expert advice **FREE**
THE EAGLE TOOL CO., Dept. A, Cincinnati, O.

To Manufacturers and Inventors

We are particularly well equipped for undertaking the sale of American manufactures marketable in Europe.

We have a department for adjusting your claims against Continental firms.

We exploit American inventions, whether already patented here or not.

We are not *"Agents,"* and can furnish satisfactory references.

UNITED STATES IMPORTING COMPANY
Hamburg, XV, Germany

I wish to increase the output of a well-established factory by the addition of a few desirable lines. Articles saleable to the hardware trade or such as could be sold direct to consumer preferred.

Inventors or owners of patents please address

J. C. CHRISTEN
Main and Dock Sts., St. Louis, Mo.

INVENTORS. MANUFACTURERS. LET US FIGURE. SPECIAL TOOLS—DIES—METAL SPECIALTIES. METAL NOVELTY WORKS CO. 43-47 SO. CANAL ST. CHICAGO.

Magical Apparatus.

Grand Book Catalogue. Over 700 engravings 25c. Parlor Tricks Catalogue, free.
MARTINKA & CO., Mfrs., 493 Sixth Ave., New York

TELESCOPES

SEND FOR CATALOGUE
W. & D. MOGEY.
BAYONNE CITY, N.J.

Telegraphy

Circular free. Wonderful automatic teacher. 5 styles $2 up. **OMNIGRAPH CO.,** Dept. 52, **39 Cortlandt St., New York.**

THE SCHWERDTLE STAMP CO. STEEL STAMPS, LETTERS & FIGURES. BRIDGEPORT CONN.

ELECTRICAL APPARATUS REPRE sented by Conventional Diagrams in Drawings.—Fifty diagrams showing the usual method of illustrating electrical apparatus in drawings. A labor saving paper. Contained in SUPPLEMENT **1106**. Price 10 cents. For sale by Munn & Co. and all newsdealers.

ENGINEERING NEWS.

Established 1874

The Leading Engineering Paper of the World. **1,600** pages of news and information relating to engineering progress in all parts of the world amply **illustrated** with drawings and photographs.

Subscription Price.— Ten weeks' trial, . . . **$1.00**
Six months, ... **2.50**
One year, ... **5.00**

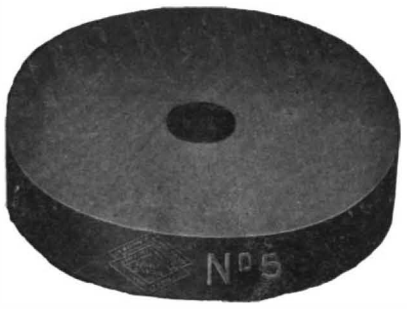
SAMPLE COPY FREE

THE ENGINEERING NEWS PUBLISHING CO., 214 Broadway, New York

DON'T BUY GASOLINE-ENGINES

UNTIL YOU INVESTIGATE "THE MASTER WORKMAN," a two-cylinder gasoline, kerosene or alcohol engine, superior to any one-cylinder engine; revolutionizing power. Its weight and bulk are half that of single cylinder engines, with greater durability. Costs Less to Buy—Less to Run. Quickly, easily started. Vibration practically overcome. Cheaply mounted on any wagon. It is a combination portable, stationary or traction engine. SEND FOR CATALOGUE. **THE TEMPLE PUMP CO., Mfrs., Meagher and 15th Sts., Chicago.** THIS IS OUR FIFTY-THIRD YEAR.

© 1907 SCIENTIFIC AMERICAN, INC.



Rubber Pump Valves

For Cold and Hot Water, Oils, Acids, High Pressure Mine Service and for every pumping requirement.

Mechanical Rubber Goods of every description of unsurpassed qualities, including BELTING, HOSE PACKINGS, Gaskets, Mats and Matting, Tubings, Springs, Interlocking Tiling, Emery Wheels and MOULDED and CUT SPECIALTIES for any mechanical and commercial device.

NEW YORK BELTING & PACKING COMPANY, Ltd.
91 & 93 Chambers Street, New York

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Safes, Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

Note the Simplicity

Of making perfect duplicates with the **Daus Tip Top Duplicator.** No intricate mechanism. No printer's ink. Always ready. 100 copies from pen-written and 50 copies from type-written original. Useful in any business. **Sent on Ten Days' Trial Without Deposit.** Complete Duplicator, cap size (prints 8¾x13 in.) $7.50, less 33 1-3 per cent. trade discount, **$5 Net**. Circular of larger sizes free on request.

Felix U. Daus Duplicator Co., Daus Building, 111 John St., New York

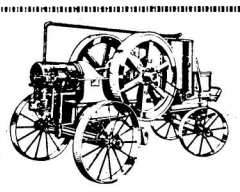
---

CRUDE ASBESTOS

DIRECT FROM MINES

PREPARED ASBESTOS FIBRE for Manufacturers use

R. H. MARTIN, OFFICE, ST. PAUL BUILDING 220 B'way, New York.



OLDS ENGINES

"Best by Every Test"
U. S. Gov't Report

For 25 years the standard. Used by U. S. Government. We build engines from 3 to 50 H. P. for all sorts of stationary and farm power. Send for catalogue.

OLDS GAS POWER CO.
958 Seager Street Lansing, Mich.

LEARN TO BE A WATCHMAKER

Bradley Polytechnic Institute
Horological Department
Peoria, Illinois
Formerly Parsons Horological Inst.
Largest and Best Watch School in America

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of Information.

TOOL KNOWLEDGE CHEAP

In fact you can have it **free!** This cut represents our new **Tool Catalogue No. 22.** It is cloth-bound and contains 950 pages **all about Tools.** Full descriptions and thousands of illustrations. Sent post-paid on receipt of $1.00 which is refunded on your first purchase from us of $10.00 or over

MONTGOMERY & CO.
105 Fulton St., N. Y. City

"THE ONLY ONE"

Here is the only double-lip, self-centering countersink having a cutting keen edge and made on the true principle for a wood-working tool. It clears itself of shavings in any kind of wood and cuts a smooth, round hole. Made from the best steel, forged, twisted and tempered. Can be sharpened from the inside without a file. Prices, 5/16 in., 35c.; 7/8 in., 40c.

Send for 232-page catalog No. 18-B.

THE L. S. STARRETT CO., Athol, Mass., U. S. A

THE Nulite Vapor GAS Lamps

For Home, Store and Street

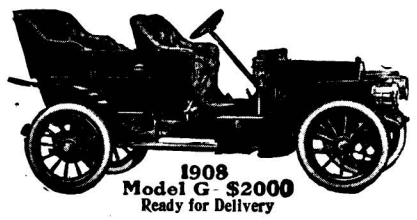
We also manufacture Table Lamps, Wall Lamps, Chandeliers, Street Lamps, Etc. 100 Candle Power seven hours ONE CENT. No Wicks. No Smoke. No Odor. Absolutely safe. THEY SELL AT SIGHT. Exclusive territory to good agents. Write for catalogue and prices.

Chicago Solar Light Co. Dept G. Chicago

GIANT STEAM SHOVELS

Toledo 125 Ohio, U.S.A. Vulcan Place

The Vulcan Iron Works Co.



1908 Model G $2000
Ready for Delivery

The Contagious Enthusiasm

of the growing army of owners of this thoroughbred

CADILLAC

Four-Cylinder 20-Horse Power

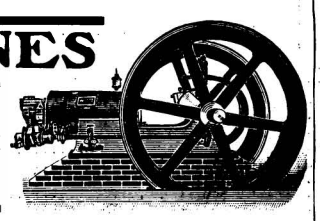
is the best proof of its extraordinary efficiency, its power, its high-grade mechanical construction—its right to class *in all respects* with many foreign and American cars of twice the price. Perfect in balance, minimized friction, simple, easy to handle and control, most economical upkeep of any four-cylinder car ever built.

The Model G is rapidly gaining the position among large cars that the single cylinder Cadillac has always held among small cars—that of pre-eminence. Ask for Catalog G-47.

CADILLAC MOTOR CAR CO., Detroit, Mich.
Members Asso. Licensed Auto. Mfrs.

WITTE GAS AND GASOLINE ENGINES

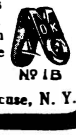
Positively beyond all question of a doubt, the highest type of perfection yet attained in modern gas engine construction. Every one built and guaranteed fully capable of developing horse-power claimed for it. **Five-Year Bond Guarantee.** All sizes. Horizontal type. Burns gas, gasoline, kerosene distillate or alcohol. New features: exclusively Bensonized bronze bearings; self-cleaning electric igniter; vertical self-seating valves; automatic wipe oilers. All parts interchangeable and adjustable. Quick deliveries. Write today for descriptive catalog "Y" and prices.



WITTE IRON WORKS CO., 546 West Fifth Street, Kansas City, Mo.

ADD TONE TO YOUR STATIONERY IN THE OFFICE, BANK, SCHOOL OR HOME BY USING ONLY WASHBURNE'S PATENT ADJUSTABLE **"O.K."** PAPER FASTENERS

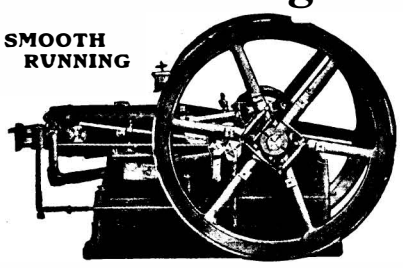
There is genuine pleasure in their use as well as *Perfect Security.* Easily put on or taken off with the thumb and finger. Can use repeatedly and *"they always work."* Made of brass, 3 sizes. Send 10c for box 50 ass't'd. At all stationers. Illustrated booklet free.



The O. K. Mfg. Co., Syracuse, N. Y.

—I. H. C.— Gasoline Engines

SMOOTH RUNNING



A line of engines adapted to the uses of all classes of mechanics. Constructed on mechanically correct principles. Everywhere distinguished for their safety and ease of management, as well as for their efficiency and economy.

Vertical style in 2 and 3 horse-power.

Horizontal (Stationary and Portable) in 4, 6, 8, 10, 12, 15 and 20 horse-power.

Also a 1-horse-power air-cooled engine.

Stocks carried by I. H. C. local agents at all principal points. Address home office for catalogs and particulars.

The International Harvester Company of America
(INCORPORATED)
15 Harvester Bldg., Chicago, Ill.

BEECHER DIVIDED WINDSHIELD

Simply constructed, easily managed, very handsome and will stand rough usage. An all-around good article. Will fit any model of any make car.

Limousine Carriage Mfg. Co.
3510 Michigan Ave., Chicago, Ill.

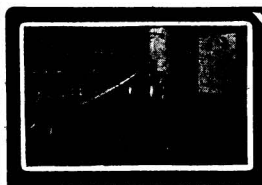
Auto Buggies, Little Roadsters

FURNISHED COMPLETE OR PARTS OF SAME

One and Two Cylinders—Vertical and Horizontal Air Cooled Motors. All Styles of Water Cooled Engines. Friction and Planetary Transmissions. Single or Double Chain Drive.

Differentials.—We Supply all the Necessary Parts to Convert Buggies into Auto Buggies.

NEUSTADT AUTOMOBILE & SUPPLY CO., 3932 Olive St., St. Louis, Mo.



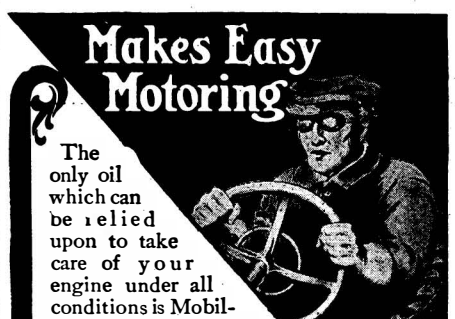
YOUR OWN ELECTRIC LIGHT PLANT.

We have Standard Complete Outfits for any size place, summer homes, residences, launches, yachts, etc. Every detail included; very best material money can buy; thoroughly practical; so simple no electrician required. **Light all the time** with our Storage Battery Outfits. **Gas, Gasoline, Kerosene** or **Steam** engines used give plenty of power for pumping water, sawing wood, refrigeration, etc.

For latest printed matter covering over a hundred outfits address
ELECTRIC DEPARTMENT

RICHARDSON ENGINEERING CO. HARTFORD, CONN.

Makes Easy Motoring



The only oil which can be relied upon to take care of your engine under all conditions is Mobiloil. Whatever the make of your automobile or the kind of engine which propels it—there is a special grade of

VACUUM
MOBILOIL

for it. Mobiloil in its five different grades is scientifically correct—its use completely eliminates all lubrication troubles.

Send for booklet which tells the proper oil for your automobile. It's free. Mobiloil is sold by dealers everywhere in barrels and cans of varying capacities. Manufactured by

VACUUM OIL CO., Rochester, N. Y.

FOR YOUR DYNAMO

Commutator Compound

(Big Stick 35 Cents)

Preserves, Lubricates, Brightens. Prevents Cutting or Sparking.

"ALLEN'S is the *only* Commutator Lubricant having official endorsement of National Board of Electrical Underwriters. Literature and small sample free for *dealer's name.*

L. B. ALLEN CO., Inc.
1335 A Columbia Avenue, Chicago
At Auto and Electrical Houses

Saves 90% THE DIAGRAPH

(Trade Mark Registered)

The Improved Stencil Cutting Machine

Is a saving of 90 per cent in your Shipping Room worth considering? Two Thousand Diagraphs in use by the Largest Houses in the United States.

"We are now perfectly satisfied that no shipping department is complete unless they have a Diagraph. It saves time, labor, gives the package a neater appearance, and is as far in advance of the old brush marking as the typewriter is ahead of the goose quill."—*Burt-Sindele Factory, National Candy Co., Buffalo, N. Y.*

Just a word will bring our free illustrated booklet describing the Diagraph and our "No Error" System of shipping goods.

American Diagraph Co., 10 N. 2d St., St. Louis, Mo., U. S. A.

---

3 to 5 H. P.
$49 Bare

Little Giant GASOLINE MOTORS

Reliable, Reversible, Two Cycle. Two and Three Port. Guaranteed for one year. Simple and easy to operate. Our Free Catalog A 3 is worth your having.

Send 10 cents in stamps for our book entitled "Ignition, Vaporization, Installation and Operation of a Gasoline Motor."

UNITED MFG. CO., - - Detroit, Mich.

DO YOU USE GRINDSTONES?

If so we can supply you. All sizes **mounted** and **unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. *Send for catalogue "I"*

The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

Expansion Bolts

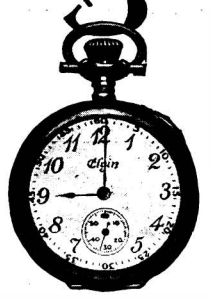
For Wood Screws

For Lag Screws

CATALOG AND SAMPLES ON REQUEST

Star Expansion Bolt Co., Trask Ave. & 2d St., Bayonne, N. J.

The Lady Elgin



The Smallest Watch Made in America

A new Elgin Watch perfectly adapted to the watch needs of womankind, yet meeting the same rigid requirements that have made the Elgin the standard watch for mankind.

Illustration actual size of watch.

Every Elgin watch is fully guaranteed; all jewelers have them—Send for "The Watch," a story of the time of day.

ELGIN NATIONAL WATCH CO.
ELGIN, ILL.

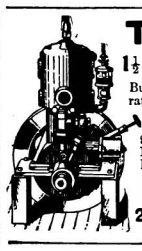
We Will Make You Prosperous

If you are honest and ambitious write us today. No matter where you live or what your occupation, we will teach you the Real Estate business by mail; appoint you Special Representative of our Company in your town; start you in a profitable business of your own, and help you make big money at once.

Unusual opportunity for men without capital to become independent for life. Valuable book A 120 and full particulars free. Write today. Address nearest office.

NATIONAL CO-OPERATIVE REALTY CO.
Phelps Bldg., Scranton, Pa. **Marden Bldg., Washington, D. C.**
Delgar Bldg., Oakland, Calif. **Athenaeum Bldg., Chicago, Ill.**

THE "LEADER."



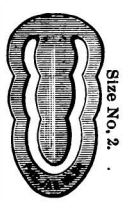
1½ H. P. Gasolene Auto-Marine Engine

Built like a watch. Beautifully Finished. Accurately Constructed. Light, Strong, Reliable, and Noiseless in operation. Suitable for launches from 15 to 19 feet in length. Price complete, $75 net, no discount. Thoroughly guaranteed. Perfect Speed Control. Complete descriptive Catalog upon application. Manufactured by

CLAUDE SINTZ,
292 S. Front St., Grand Rapids, Mich.

THE EUREKA CLIP

The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**



Size No. 2.

IT PAYS BIG To amuse the Public With Motion Pictures

NO EXPERIENCE NECESSARY as our instruction Book and **"Business Guide"** tells all. We furnish Complete Outfits with Big Advertising Posters, etc. Humorous dramas brimful of fun, travel, history, religion, temperance work and songs illustrated. One man can do it. **Astonishing Opportunity** in any locality for a man with a little money to show in churches, school houses, lodge halls, theatres, etc. **Big profits each entertainment.** Others do it, **why not you?** It's easy; write to us and we'll tell you **now. Catalogue free.**

AMUSEMENT SUPPLY CO., 467 Chemical Bank Bldg., CHICAGO.

HELMET OIL LUBRICATES ANYTHING SEND FOR SAMPLE FREE 15-21 S. CLINTON ST. CHICAGO, ILL. U.S.A.

C. H. BESLY & CO.

© 1907 SCIENTIFIC AMERICAN, INC.